RECENT ECONOMIC CHANGES

IN THE UNITED STATES

REPORT OF THE COMMITTEE ON RECENT ECONOMIC CHANGES,
OF THE
PRESIDENT'S CONFERENCE ON UNEMPLOYMENT

HERBERT HOOVER, CHAIRMAN

INCLUDING THE REPORTS OF A SPECIAL STAFF OF THE
NATIONAL BUREAU OF ECONOMIC RESEARCH, INC.

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FOREWORD

As an outgrowth of the President's Conference on Unemployment of 1921, three national surveys have been set up to enlarge the general understanding of our economic system and to stimulate the continuing reduction of unemployment. The first of these surveys was the study of Business Cycles and Unemployment made in 1922–23 for a committee of the Unemployment Conference. The second was a study of Seasonal Operation in the Construction Industries made in 1923–24 for another committee of the Conference.

The survey of Recent Economic Changes, begun in January, 1928, and completed in February, 1929, is an analysis of post-war developments in American economic life, particularly those since the recovery from the depression of 1920–21. The committee consists of Herbert Hoover, Chairman; Walter F. Brown, Renick W. Dunlap, William Green, Julius Klein, John S. Lawrence, Max Mason, George McFadden, Adolph C. Miller, Lewis E. Pierson, John J. Raskob, A. W. Shaw, Louis J. Taber, Daniel Willard, Clarence M. Woolley, Owen D. Young, and Edward Eyre Hunt, Secretary.

The committee was directed to make a critical appraisal of the factors of stability and instability; in other words, to observe and to describe the American economy as a whole, suggesting rather than developing recommendations.

In its later deliberations the chairman, Herbert Hoover, was unable to take part and A. W. Shaw served as acting chairman.

The basic investigations for the Committee on Recent Economic Changes, like those for the Committee on Business Cycles and Unemployment, were made under the auspices of the National Bureau of Economic Research, Inc., with the assistance of an unprecedented number of governmental and private agencies.

While the National Bureau is solely responsible for the basic survey, the committee is solely responsible for the interpretation of the facts set out in the following brief report.

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SECTION I

CHARACTERISTICS OF THE YEARS 1922-1929

Acceleration rather than structural change is the key to an understanding of our recent economic developments. Gradually the fact emerged during the course of this survey that the distinctive character of the years from 1922 to 1929 owes less to fundamental change than to intensified activity.

Forty years ago David A. Wells wrote his "Recent Economic Changes," showing that the quarter century which ended in 1889 was a period of "profound economic changes," which he described as "unquestionably more important and varied than during any former corresponding period of the World's history."

Each generation believes itself to be on the verge of a new economic era, an era of fundamental change, but the longer the committee deliberated, the more evident it became that the novelty of the period covered by the present survey rested chiefly in the fact that developments such as formerly affected our old industries have been recurring in our new industries. The changes have not been in structure but in speed and spread.

Invention is not a new art. Transportation and communication are not new services. The facilitating function of finance is older than coined currency. Agriculture is as ancient as history. Competition is not a new phenomenon. None of the changes in distribution on which emphasis has been laid in the last few years is basically new. Hand-to-mouth buying is old; sudden changes in style and demand are familiar; there is no new principle in installment selling; cooperative marketing is no modern discovery; the chain store movement dates back at least 25 years.[1] But the breadth and scale and "tempo" of recent developments give them new importance.

The increased supply of power and its wider uses; the multiplication by man of his strength and skill through machinery, the expert division and arrangement of work in mines and factories, on the farms, and in the trades, so that production per man hour of effort has risen to new heights; the quickening of these instrumentalities through capital provided from the surplus incomes of a constantly widening proportion of our people—all these represent an accumulation of forces which have long been at work.

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[1] See Chap. V, Marketing.

The committee, like other observers, was early impressed by the degree of economic activity in these seven years. It was struck by the outpouring of energy which piled up skyscrapers in scores of cities; knit the 48 States together with 20,000 miles of airways; moved each year over railways and waterways more than a billion and a half tons of freight; thronged the highways with 25,000,000 motor cars; carried electricity to 17,000,000 homes; sent each year 3,750,000 children to high school and more than 1,000,000 young men and women to college; and fed, clothed, housed, and amused the 120,000,000 persons who occupy our twentieth of the habitable area of the earth.

But while the period from 1922 to 1929 has been one of intense activity, the committee noted that this activity has been "spotty." Certain groups have been more active than other groups; certain industries busier than their neighbor industries, and certain geographical areas more prosperous than other areas.[2]

While rayon manufacturers have worked at top speed, cotton mills have been on part time; while the silk hosiery industry, the women's shoe trade, and the fur business have been active, there has been depression in the woolen and worsted industry; while dairying has been prosperous, grain growers have been depressed. Coal mining has been in difficulties, and classes of wholesalers and retailers have been under grave economic pressure. Progress has been made toward more stable employment in seasonal industries, yet "technological" unemployment, resulting from the displacement of workers by improved machinery and methods, has attracted attention.[3]

Geographical differences also were noted. The Pacific States have made an extraordinary advance; the South has rapidly developed as a manufacturing area; the East North Central Division has grown; while the New England States and to some extent the Middle Atlantic section, have developed less rapidly and have experienced some difficulties in adapting their older industries to new conditions.

However, in spite of this variability, this difference in activity as between groups and areas and industries, the rising standard of living characteristic of this period was widespread, and has reached the highest level in our national history.

[2] See Chap. XII, The National Income and its Distribution.

[3] See Chap. II, Industry; Chap. V, Marketing; Chap. VI, Labor; and Chap. VII, Agriculture.

Participation by the people as a whole in many of the benefits of increased productivity, which of itself varied as between different groups and geographical areas, has been one of the marked characteristics of the period. While industrial, agricultural, and commercial activity has been "spotty," the broad social advantages of our accelerated activity flowed out over the land. For example, the highway building programs throughout the nation were not limited to the intensely active areas; good roads were extended in all directions, serving the whole population. The same might be said for educational advantages, radio entertainment, personal mobility made possible by low-priced motor cars, swift and dependable transportation and communication, and numerous other facilities and services making for comfort and well-being, beyond the elemental requirements of food, clothing, and shelter.[4]

This spread of higher living standards has been characteristic of our national life practically throughout our history. As a phenomenon it is not new, but in its degree and scope it has taken on a new importance.

THE SPEED WHICH POWER HAS ADDED TO PRODUCTION

Characteristic also has been the rise in the use of power—three and three-quarters times faster than the growth in population—and the extent to which power has been made readily available not alone for driving tools of increasing size and capacity, but for a convenient diversity of purposes in the smallest business enterprise and on the farm and in the home.

Factories no longer need cluster about the sources of power. Widespread interconnection between power plants, arising out of an increasing appreciation of the value of flexibility in power, and made possible by technical advances during recent years, has created huge reservoirs of power so that abnormal conditions in one locality need not stop the wheels of industry.[5]

The increasing flexibility with which electricity can be delivered for power has enabled manufacturers and farmers to meet high labor costs by the application of power-driven specialized machines; and power in this flexible form has penetrated into every section of the United States, including many rural areas. The survey shows that as a nation we now use as much electrical energy as all the rest of the world combined.

Through the subdivision of power the unskilled worker has become a skilled operator, multiplying his effectiveness with specialized automatic machinery and processes. Thus the unit cost of production has been reduced, the drudgery eliminated from much unskilled work, and wages maintained or actually increased.

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[4] See Chap. I, Consumption and the Standard of Living; Chap. III, Construction; Chap. IV, Transportation.

[5] See Chap. II, Parts 1, 2, and 3.

THE SPREAD IN THE SOURCE AND USE OF CREDIT

This acceleration of forces and its resultant rising standard of living have been facilitated by a continuing supply of funds.

In the breadth of the sources from which capital and credit have been available and in the quickening method of their use, may be observed again the changes in speed and spread of our recent economic activity.

In former periods the savings funds of the American people were not alone adequate for our capital requirements. In periods of business expansion the demand for funds pressed heavily upon the supply.

The reverse has been found to be true in the period under review. For the larger part of this period not only the earnings and savings of the people supplied the additional capital for financing the rapid development of industry, but in addition they furnished several billions of dollars for loans to foreign countries.[6]

Stimulated by the urge for funds to finance the vast production program of the United States during the World War, the number of share holders in the country's business enterprises has grown enormously, according to all estimates; and out of increasing incomes these investors have continued to pour their savings into the stream of credit.

During the later months of the period covered by the survey a new tendency has been observed. Investors, as well as a large body of speculators, have invested through the Stock Exchanges not only their savings, but the proceeds of loans secured through banks and brokers, until the credit structure of the country has been sufficiently weighted to indicate a credit stringency, resulting in an abnormally high rate for call money and an appreciable increase in the rate of interest for business purposes. The consequences of this process can not be measured at this time, but they are factors in the problem of maintaining economic balance which will be touched on later in this report.

Meanwhile industry has been able to reduce its requirements for short-term credits from the banks through issuance of securities. The preference for permanent methods of financing business is reflected in the relatively small increase in commercial loans of banks in recent years, as contrasted with the increase in security holdings and collateral loans.

Imports of gold early in the period covered by the survey which tended to make credit easier; the growth of savings in spite of increased spending; the popular confidence in the financial structure, especially in the Federal Reserve System, and the power of the System to move available credit to the places where it is needed, mark a great advance during these seven years.

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[6] See Chap. X, Money and Credit and their Effect on Business, and Chap. XI, Foreign Markets and Foreign Credits.

There has also been an increase in the velocity of the turnover of credit, due to improved transportation and communication, scientific control of inventories, the continuation of the simplification movement, and our accelerated turnover of commodities. Business has thus developed a new degree of economy in the use of credit, which may be set down as another characteristic of the period.

SECTION II

PRICE RELATIONSHIPS, WAGES, AND THE COST OF LIVING

The period under review is perhaps too brief for a definite judgment, and we are as yet too close in point of time to get an accurate perspective, but the committee feels that in the field of price relationships, wages, and the cost of living is to be found one of the striking and significant developments revealed by the survey, and one which more than any other gives these years their distinctive character.

Contrasting two periods of our comparatively recent economic history will perhaps serve to make clear the significance of these factors.

According to the best available statistics, in the period between 1896 and 1913, the wholesale price level rose on the average 2.3 per cent a year, but wages rose only a little more; so that their purchasing power advanced only 0.5 per cent a year. In the period from 1922 to 1927, prices declined on the average 0.1 per cent a year, while the purchasing power of wages rose 2.1 per cent a year.[7]

In this latter period the fortunate synchronizing of a high wage level and a stationary cost of living created a phenomenon, new in degree, which had widespread influence on the economic situation, and which will bear close study in its details.

RELATIVE PRICE STABILITY

The increasing tendency toward price stability, both as between classes of commodities and in the price experience of individual commodities, was a characteristic of the period under review, tending toward a more equitable basis of exchange of products among the various groups. Price fluctuations seem to have been held within narrow limits during this period by a combination of factors: A more complete background of statistical information making possible better judgment regarding supply and demand on the part both of producers and consumers; prudence on the part of management; cost reductions by technicians, skill on the part of bankers, an enlightened attitude on the part of labor, and the expansion of foreign markets.

Relative price stability has involved a change in the direction in which business men look for profits. Profits made from the fluctuations of individual commodity prices, and from changes in the relation among prices, have tended to diminish.

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[7] See Chap. IX, Price Movements and Related Industrial Changes.

Whether the price relationships of recent years prove to be transitory or permanent, they represent to-day a huge gain which is reflected in all parts of the economic organism. It is a development too new to permit of dogmatic interpretation but the committee believes that this decreasing variability in prices at a time when the productivity per hour of labor has been greatly increased, and the demand for goods has been greatly stimulated, is one of the most significant factors disclosed by the survey.

The widening gap between wages and the cost of living—wages increasing while the cost of living was stationary—may be assumed to have contributed definitely to the degree of prosperity which has characterized the period as a whole. With rising wages and relatively stable prices we have become consumers of what we produce to an extent never before realized.

The factors in this situation appear in part to be accidental and in part the consequences of an advanced economic point of view.

In the early postwar period much of the press and many employers demanded a "liquidation" of labor. It was freely declared that business could not settle down until wages were brought back to prewar levels. Labor had enjoyed a higher standard of living and naturally opposed wage cuts.

This might have precipitated a period of serious strife, had it not been that leaders of industrial thought, watching the trend of affairs, noted that the result of the continuance of high wages was that the dammed-up purchasing desires which had been held back during the war on account of the national economic program, burst forth and not only the high wages which were being currently earned but accumulated savings as well were poured into the channels of commerce.

They were quick to grasp the significance of the power of the consumer with money to spend to create an accelerated cycle of productivity.

They began consciously to propound the principle of high wages and low costs as a policy of enlightened industrial practice. This principle has since attracted the attention of economists all over the world, and while it is in no sense new, its application on a broad scale is so novel as to impress the committee as being a fundamental development.[8]

PRODUCTION INCREASE AND THE EXPANSION OF HUMAN WANTS

Partly as a result of this newly sensed principle of an accelerated cycle of production-consumption, and partly by reason of the development of a stream of credit and an abundance of flexible power made broadly available, the years 1922 to 1929 witnessed a marked increase in the physical volume of production. Some years stand out more conspicuously than others; two—1924 and 1927—show minor recessions; but the period as a whole has been notably consistent.

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[8] See Chap. VII, Management.

Since 1922 primary production has been increasing 2.5 per cent a year; manufacturing, 4 per cent; and transportation, 4 per cent. Taking 1919—a year of fair harvests—as a base, crop production in 1922 was 102; in 1925, 104; in 1927, 106.

There have been prosperous periods in the past which may have surpassed these rates of increase, but none so far as the committee can learn which has shown such a striking increase in productivity per man-hour. Notwithstanding the reductions in hours of labor, per capita productivity is nearly 60 per cent greater than it was toward the close of the nineteenth century; the increase in per capita productivity in manufacturing from 1922 to 1925 was 35 per cent; the productivity of farm workers has increased at a rate probably never before equaled.

And these increases in productivity have been joined to a corresponding increase in the consuming power of the American people. Here has been demonstrated on a grand scale the expansibility of human wants and desires.

Economists have long declared that consumption, the satisfaction of wants, would expand with little evidence of satiation if we could so adjust our economic processes as to make dormant demands effective. Such an expansion has been going on since the beginning of the Industrial Revolution. It is not a phenomenon of the postwar period, except in degree. But it is this degree of economic activity, this almost insatiable appetite for goods and services, this abounding production of all things which almost any man can want, which is so striking a characteristic of the period covered by the survey.

OPTIONAL CONSUMPTION

The committee finds, from study of the fact-finding survey on which this report is based, that as a people we have become steadily less concerned about the primary needs—food, clothing, and shelter. We have long since lost all fear concerning our food supply, and so we no longer look on food as a luxury or as a primary source of pleasure. American food standards have risen, but we hear little of the "high cost of living," and the slogan of the "full dinner pail," is obsolete. We wear less clothing; more rayon and silks, less cotton and wool. Our wants have ranged more widely and we now demand a broad list of goods and services which come under the category of "optional purchases."[9]

The rapidly increasing number of families in the United States having a considerable margin of earnings available for "optional consumption"—optional in the sense that this portion of the income may be saved or spent, and if spent the manner of its spending may be determined by the tastes of the consumer or the nature of the appeals made to him by the industries competing for his patronage—presents one of the marked characteristics of the recent economic situation. It is the personal or individual expression of the gap between rising wages and the relatively stable cost of living, referred to at the beginning of this section.

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[9] See Chap. I, Consumption and the Standard of Living.

CONSUMPTION AND LEISURE

Closely related to the increased rate of production-consumption of products is the consumption of leisure.

It was during the period covered by the survey that the conception of leisure as "consumable" began to be realized upon in business in a practical way and on a broad scale. It began to be recognized, not only that leisure is "consumable," but that people can not "consume" leisure without consuming goods and services, and that leisure which results from an increasing man-hour productivity helps to create new needs and new and broader markets.

The increasing interest in the fine arts and in science; the increased sales of books and magazines; the increase in foreign travel; the growing interest and participation in sports of all kinds; the domestic pilgrimages of some 40,000,000 motor tourists who use more than 2,000 tourist camps; the greatly increased enrollment in our high schools and colleges; the motion picture theaters and the radio—all these reflect the uses of increasing leisure.

During the period covered by the survey the trend toward increased leisure received a considerable impetus. The work week was shortened in the factory by better planning and modern machinery, and the work day was shortened in the home by the increased use of time-and-labor-saving appliances and services.[10]

Few of the current economic developments have made such widespread changes in our national life or promise so much for the future as the utilization of our increasing leisure.

"MASS SERVICES"

The service functions are not new, but few of the developments revealed by the survey are of greater potential significance than the accelerated growth of our service industries—travel, entertainment, education, insurance, communication; the facilities of hotels, restaurants, delicatessen stores, steam laundries, and public libraries, to mention but a few.

An evolution which has been going on for centuries has only recently been revealed as a mass movement. We now apply to many kinds of services the philosophy of large-scale production. We have integrated these services and organized them, and we have developed the new philosophy to such a degree in recent years that we now have what might be termed "mass services." These have helped to create a new standard of comfortable living in the United States, and have afforded employment for millions of workers crowded out of agriculture and the extractive and fabricating industries.

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[10] See Chap. VI, Labor.

It was, in fact, the timely development of "mass services" which saved our country from a critical unemployment problem during recent years.

No serious cyclical fluctuations have characterized the period under review,[11] so that the unemployment due to the business cycle has not been marked; but it has become evident that unemployment can arise as a result of industrial efficiency as well as of inefficiency. In the latter case we have seasonal or intermittent unemployment; in the former case what has come to be known as "technological" unemployment resulting from the introduction of new machinery and processes. The survey seems to indicate that the time has come to devote continuing attention not only to the problems of cyclical unemployment but also to this newer problem of "technological" unemployment if we are to forestall hardship and uncertainty in the lives of the workers.[12]

Where progress may be working an advantage to the people as a whole, it inevitably works temporary hardship upon certain classes—those skilled workers in a trade, for example, whose work is taken over by machines. This is a serious aspect of the problem of unemployment. It involves, in many instances, learning new trades, and, in most instances, the loss of time in securing other jobs. Yet from a broad social point of view, while it works hardship on those workers displaced by the introduction of machinery or improved processes, the social gain is real and permanent.

Such economic transformations are not so much changes as readjustments, due to the progressive needs of modern society, and to the necessity of taking advantage of the modern developments in science. They have arisen in agriculture as well as manufacturing and transportation, and they have affected employers as well as employees. There is nothing new about these problems; the accelerated rate of readjustment is what has recently engaged the attention of wage earners and management.

As has already been intimated, the acceleration of technological shifts in production and consumption would have resulted in much more serious unemployment if workers had not been absorbed in the newly expanded service industries which both create and serve leisure.

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[11] See a Review.

[12] See Chap. VI, Labor; Chap. VII, Management; and Addenda, Unemployment.

OUR NATURAL ADVANTAGES

It is obvious, of course, that the economic position of this nation is in no slight degree due to our possession of abundant raw materials and sources of power, to the fact that our domestic market is so large, and that there are no trade barriers between the States of our Union. We can exchange goods without stopping them for inspection or the payment of duties between States. We can effect their transfer without the barriers of differing languages or customs. Advertising is peculiarly effective because we have so great an area with a common language which enables us to talk to all the people and to develop national consumption habits, which in turn make possible large-scale production.

This fortuitous situation should be borne in mind as an important factor in both the speed and the spread which have characterized our recent economic development.

The balance which has been maintained between consumption and production is nowhere better shown than in the fact that wages have been rising, and that there has been no striking increase of unemployment in a period marked by the broadest technological advancement which we have yet known.

Perhaps the deepest economic significance of the new situation lies, not in the rapidity with which the service industries have grown and have become integrated, nor in the universality of their spread, but in the fact that the situation which they have created is reciprocal. Our increasing standard of living is not participated in only by those who produce our food, clothing, and shelter, but has flowed back to those in the service industries. The population as a whole can enjoy the rising standard of living—the music which comes in over the radio, the press, the automobile and good roads, the schools, the colleges, parks, playgrounds, and the myriad other facilities for comfortable existence and cultural development.

Our ancestors came to these shores with few tools and little organization to fight nature for a livelihood. Their descendants have developed a new and peculiarly American type of civilization in which services have come to rank with other forms of production as a major economic factor.

REMOTE SATURATION POINTS

The survey has proved conclusively what has long been held theoretically to be true, that wants are almost insatiable; that one want satisfied makes way for another. The conclusion is that economically we have a boundless field before us; that there are new wants which will make way endlessly for newer wants, as fast as they are satisfied.

We have the power to produce and the capital to bring about exchange between the producing and consuming groups. We have communication to speed and spread the influence of ideas. We have swift and dependable transportation. We have an educational system which is steadily raising standards and improving tastes. We have the sciences and arts to help us. We have a great national opportunity.

Important as is the development of the economic side of our national life, through invention and discovery of new industries and new callings, an illustration of the potentialities of further lifting the national standard of living, without developing another invention or discovery and without creating a new want, can be drawn from a single industry—that of electrical appliances.

A home or farm wired for electricity is a different economic unit from one which is not wired. Each such home, whether in city or country, can take advantage of electricity for lighting, and on the farm an automatic water supply system makes available water at convenient spots for domestic and farm uses.

A survey of city and village homes indicates the use of electricity for many additional applications of highly specialized devices. In 1928 apparently a large percentage of the homes wired for electricity had electric flatirons; less than one-third of them had washing machines; slightly over one-third of them had vacuum cleaners; less than 5 per cent had electrical refrigerators. We are far from the saturation point in connection with any of these devices.

To take one other example, there is, perhaps, no more dramatic illustration of a rising standard of living than the growth and development of radio in recent years. This newest application of electricity has found its way into millions of homes. On January 1, 1928, there were 7,500,000 sets in use. Yet about 70 per cent of American homes are still without the radio.[13]

We seem only to have touched the fringe of our potentialities.

SECTION III

ECONOMIC BALANCE

Many influences have been at work during the period covered by the survey, welding the people of the United States into a new solidarity of thought and action. The telephone and telegraph, the automobile, the radio, and the railroads form lines of communication which have brought together East and West, South and North.

Other and less tangible influences reaching back farther into the past, but accelerated and strengthened by the experiences of the World War, have also contributed to our solidarity. Economic reorganization; the cooperation of business leaders, economic experts, and the Government;

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[13] See Chap. I, Consumption and the Standard of Living.

the general spread of information; the growth of trade associations; the cooperation of labor to increase productivity; the restriction of immigration—all of these have grown in importance in peace after their stimulation by the war.

Making for solidarity has been popular education which has increased amazingly. We are spending two and one-half billions of dollars each year on public and private education—an increase of 250 per cent in a decade. Expenditures for free college and university education have increased nearly 350 per cent in little more than 10 years.

And there is another factor which has contributed to the welding process, and to the economic advancement of the nation: The broadening influence of America's creative minds—the minds of the leaders in Government and in education, in research, in management and in labor, in the press, and in the professions. To their influence we have come to look in large measure for the maintenance of our economic balance.

While ours has been a period of great economic activity and industrial productivity, and of a degree of economic stability which must be rated as high when we consider the readjustments in every department of economic life made necessary by the postwar crisis and by the transition from war economy to peace economy, and while America has a promising future, the outstanding fact which is illuminated by this survey is that we can not maintain our economic advantage, or hope fully to realize on our economic future, unless we consciously accept the principle of equilibrium and apply it skillfully in every economic relation.

The forces that bear upon our economic relationships have always been sensitive. All parts of our economic structure from the prime processes of making and of marketing to the facilitating functions of finance, are and have been interdependent and easily affected. And therein lies the danger: That through ignorance of economic principles, or through selfish greed, or inadequate leadership, the steady balance will be disturbed, to our economic detriment.

If natural resources, especially the land, are wastefully used; if money in quantity is taken out of production and employed for speculation; if any group develops a method of artificial price advancement which puts one commodity out of balance with other commodities; if either management or labor disregards the common interest—to this extent equilibrium will be destroyed, and destroyed for all.

To maintain the dynamic equilibrium of recent years is, indeed, a problem of leadership which more and more demands deliberate public attention and control. Research and study, the orderly classification of knowledge, joined to increasing skill, well may make complete control of the economic system a possibility. The problems are many and difficult, but the degree of progress in recent years inspires us with high hopes.

In the marked balance of consumption and production, for example, the control of the economic organism is increasingly evident. With the development of a stream of credit to facilitate business operations, and with flexible power to energize industry and to increase the effectiveness of the workers, has come an increasing evenness in the flow of production. Once an intermittent starting and stopping of production-consumption was characteristic of the economic situation. It was jerky and unpredictable, and overproduction was followed by a pause for consumption to catch up. For the seven years under survey, a more marked balance of production-consumption is evident.

With greater knowledge of consuming habits, with more accurate records of the goods consumed, a sensitive contact has been established between the factors of production and consumption which formerly were so often out of balance.

Where pools of goods once were accumulated by the manufacturer, the wholesaler, the jobber, and the retailer; where high inventories once meant distress, shutdowns, failures, and unemployment whenever the demand subsided, there is now a more even flow from producer to consumer.

Increasing skill and scientific data have made the anticipation of demand far more accurate, and by accurate anticipation the deliberate balance between production and consumption has in a measure been maintained. By advertising and other promotional devices, by scientific fact finding, by a carefully predeveloped consumption, a measurable pull on production has been created which releases capital otherwise tied up in immobile goods and furthers the organic balance of economic forces. In many cases the rate of production-consumption seems to be fairly well under control.

To maintain this balance, and to extend it into fields which are not now in balance with the more prosperous elements of the nation, is clearly an important problem of leadership. With certain natural resources still wastefully exploited, with great industries, such as agriculture and coal mining, still below the general level of prosperity, with certain regions retarded, there remains much to do. To bring these more fully into the stream of successful economic forces is a problem of the first order.

Our complex and intricate economic machine can produce, but to keep it producing continuously it must be maintained in balance. During the past few years equilibrium has been fairly well maintained. We have not wasted the hours of labor by strikes or lockouts. Until recently we have not diverted savings from productive business to speculation. There has been balance between the economic forces—not perfect balance, but a degree of balance which has enabled the intricate machine to produce and to serve our people.

As long as the appetite for goods and services is practically insatiable, as it appears to be, and as long as productivity can be consistently increased, it would seem that we can go on with increasing activity. But we can do this only if we develop a technique of balance. Toward such a technique the committee believes the skillful work of the economists, engineers, and statisticians who prepared the survey on which we have based the facts and interpretations expressed in this brief report, will contribute. Our effort has been to suggest a pattern by which their work may be appraised; to set up an orderly plan by which the facts may be articulated and against which later and better information may be more accurately judged. We recommend a study of the fact finding survey as a whole to all who are faced with the problems of business administration and public leadership.[14]

Informed leadership is vital to the maintenance of equilibrium. It depends upon a general knowledge of the relations of the parts each to the other. Only through incessant observation and adjustment of our economy, can we learn to maintain the economic balance.[15]

Underlying recent developments is an attitude of mind which seems to be characteristically American. Our nation is accustomed to rapid movement, to quick shifts in status; it is receptive to new ideas, ingenious in devices, adaptable. Our economy is in large measure the embodiment of those who have made it.

Our situation is fortunate, our momentum is remarkable. Yet the organic balance of our economic structure can be maintained only by hard, persistent, intelligent effort; by consideration and sympathy; by mutual confidence, and by a disposition in the several human parts to work in harmony together.

Herbert Hoover
Walter F. Brown
Renick W. Dunlap
William Green
Julius Klein
John S. Lawrence
Max Mason
George McFadden
Adolph C. Miller
Lewis E. Pierson
John J. Raskob
Arch W. Shaw
Louis J. Taber
Daniel Willard
Clarence M. Woolley
Owen D. Young
Edward Eyre Hunt

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[14] See Addenda, Statistics.

[15] See Addenda, Periodic Surveys and Appraisals.

ADDENDA

Unemployment.—Rather than to recapitulate the findings of its predecessors, the committee refers the reader to the report of the President's Conference on Unemployment of 1921, and to the reports of its two committees dealing with cyclical and seasonal unemployment: Business Cycles and Unemployment, published in 1923 by a committee of the conference, together with a fact-finding survey of the National Bureau of Economic Research, Inc., and Seasonal Operation in the construction Industries, published in 1924 by another committee of the conference, dealing with seasonal employment.

The report on Business Cycles, as the present survey shows, has exerted an important influence toward reducing the extremes of cyclical fluctuations. The report on Seasonal Construction has stimulated an increase in offseason building and has thereby lengthened the building year.

The report recently published by the Senate Committee on Education and Labor, pursuant to Senate Resolution 219 of the Seventieth Congress, is further evidence of the continuing interest in more stable employment.

Statistics.—The complexity of American economic activities and the rapid changes in them call for more statistical data. Without attempting exhaustive enumeration, the more conspicuous gaps and deficiencies may be briefly mentioned:

1. Little statistical material is now collected regarding several important branches of economic activity, particularly those which render services. The recent shift of workers from farms and factories into the service fields makes statistical data concerning those fields particularly essential at this time. To that end the classification and analysis of the statistics of occupations of the census of 1930 should be given special attention. A census of distribution is another major need. Data should also be obtained regarding the construction industry, automobile repair shops, hotels and restaurants, and similar enterprises, and establishments providing recreation, instruction, and amusement.

2. There is need of more complete statistical information regarding labor. In addition to more adequate occupation statistics, current annual and monthly returns of employment and pay rolls should be extended to the major fields of activity not now covered. Wage and earning statistics should be more comprehensive and in addition to averages the number of workers should be classified according to the amounts received. Similar information is needed concerning hours of labor.

3. Although improvement has recently been made in price statistics further expansion and more thorough analysis are desirable. The great and growing importance of elaborate, often nonstandardized, commodities makes it difficult to compute general price indexes which correctly measure changes in the buying power of money. The most pressing immediate need is for a revision of the indexes of cost of living as a means of interpreting changes in the buying power of money wages and other incomes. There is call also for more complete analysis of the price levels of groups of commodities based on a number of different principles of classification, as well as for more detailed statistics of the prices of individual articles. Special price statistics for different sections of the country would serve a useful purpose.

4. We need more statistical information regarding the values, gross and net, of the products and services of different branches of industry, both as a basis for ascertaining aggregate national income, and as a means of comparing the productivity of different branches and determining the trends in them. In the census of manufactures it would be useful to distinguish the cost of raw materials furnished by nonmanufacturing industries from the cost of semimanufactured goods supplied by other factories; among other advantages this would facilitate comparisons between production and export of manufactures.

5. In many cases the utility of statistics would be greatly increased by publishing them for smaller areas than are now distinguished.

6. As regards many classes of statistics greater accuracy and representativeness should be sought. Statistical series are often based on the principle of sampling and the samples are not always truly representative. There is reason to believe, for example, that most series relating to employment and amount of pay roll and some relating to production have a downward bias due to inadequate covering of new plants. Current series of this character should be adjusted on the basis of more comprehensive statistics collected at intervals such as those of the biennial census of manufactures.

7. Even where the original statistical data are adequate the analysis of them is often unsatisfactory and comparisons with other series difficult or impossible. For example, index numbers are computed with reference to different base periods, and averages for groups of years are made up for incomparable periods of time. Certain monthly series are adjusted for variations in the length of the month or for seasonal factors while such adjustment is not made for other series. Commodities and groups of commodities, industries and groups of industries, are differently defined by the several statistical authorities. Standardization and coordination of methods of analysis would add greatly to the value of economic statistics and will become still more essential as their scope is further expanded.

The needs in the field of statistics, above set forth, and others not specifically mentioned, suggest that there should be organized cooperation among the producers of statistics and organized consultation with the users of statistics. A multiplicity of agencies, governmental and private, are engaged in collecting statistical data. The work of the Federal Government alone in this field is divided among numerous bureaus and organizations.

There are weighty arguments against the proposal sometimes put forward that the bulk of the government's statistical work should be concentrated in a single bureau. On the other hand, the committee believes that the time has come to consider setting up a Central Statistical Committee to act as a coordinating agency. Such a committee might include representatives of the major statistical organizations of the Federal Government together with members and consultative advisors from the outside, representing the statistical profession as such, business men, farmers, wage earners, and others concerned with the results of statistical inquiry. The committee would consider such questions as the new statistics needed from time to time, the organization by which they should be handled, and the methods of collecting, analyzing, and presenting statistical data. Its recommendations, made directly to the several statistical organizations of the Government, or where necessary to the heads of departments, the President, or the Congress, would carry weight even should it be deemed best to give to the committee no final authority in these matters.

Periodic Surveys and Appraisals.—Various problems have not been treated at any length in the survey made for our committee by the National Bureau of Economic Research, Inc. Air transport is in its infancy, new methods of financing have been only sketched, mergers can not yet be appraised with any degree of satisfaction, the future of gold and of credit is just touched upon, the growth of stock exchange operations can not yet be judged with finality, investment trusts are rapidly growing, forest depletion is only mentioned, and the exhaustion of the soil in certain localities is once alluded to. Immigration, prohibition, taxation, and similar topics deserve separate volumes rather than incidental reference.

Developments in connection with each of these topics have important economic significance. Most of them are already the subject of widespread interest, and some of them of investigation by governmental or private agencies. Noteworthy among these is the recent report and recommendations of the National Association of Securities Commissioners representing the regulatory authorities of 37 States on the regulation of investment trusts.

We are impressed with the need of continuing impartial fact-finding as to these and similar subjects as they arise, and with the desirability of their periodic interpretaton for public use.

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In carrying out its program, the committee has received generous cooperation and advice from governmental and private agencies, organizations, groups, and individuals to a degree never before equaled in an undertaking of this sort. It is probable that valuable assistance was rendered by many whose names are unknown to the committee. To these, then, as well as to those whose names are known, the committee expresses its deep appreciation.

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Building Officials Conference.

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Food Research Institute.
General Federation of Women's Clubs.
Illuminating Engineering Society.
Industrial Survey and Research Service.
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INVESTIGATION MADE UNDER
THE AUSPICES OF THE NATIONAL
BUREAU OF ECONOMIC RESEARCH, INC.

EDITOR'S NOTE

Plans for the study of Recent Economic Changes were first discussed in August, 1927. Detailed plans were made in September of that year and were approved by the Executive Committee of the National Bureau of Economic Research, Inc., on October 17. The recruiting of the staff of collaborators was begun in December, and the first meeting of those who were to conduct the several parts of the survey was held on February 21, 1928.

In addition to numerous staff meetings for consultation among themselves, the collaborators met on various occasions with members of the Committee on Recent Economic Changes to report progress and to discuss the results of their surveys.

The first of the chapters in tentative form was submitted to the editor on August 20, 1928, and the last on February 28, 1929. Between these two dates fruitful discussion between the collaborators and the members of the Committee on Recent Economic Changes continued at intervals, and the final drafts of the chapters, with one exception, were completed by February 1, 1929. Following the procedure of the National Bureau, which is a scientific body dealing only with topics of national importance which are susceptible of quantitative treatment, the findings are issued in the form of fact reports, and are published with the approval of its Board of Directors.

In my dual role as secretary of the Committee on Recent Economic Changes and editor of the report prepared under the auspices of the National Bureau, I have been particularly indebted to Dr. Wesley C. Mitchell and Dr. Edwin F. Gay, directors of research, and to Mr. Gustav R. Stahl, executive secretary. Thanks are also due to the authors of the chapters for their skill and promptness and to the members of the Board of Directors who passed upon the voluminous manuscripts.

In the list of general acknowledgments the committee expresses its gratitude to a large number of organizations and individuals for exceptional services. I desire to mention here the service rendered by Mr. Frank Johnson, of the Department of Commerce, who prepared the manuscripts for the printers and that of Mr. Rudolf von Huhn, also of the Department of Commerce, who acted as editor of graphs and charts. My thanks are also due to Dr. Gay who kindly assumed the responsibility for reading and correcting the proofs.

EDWARD EYRE HUNT.

WASHINGTON, D. C.,
May 1, 1929.

RESOLUTION

ON THE RELATION OF THE DIRECTORS TO THE ECONOMIC WORK OF THE BUREAU

1—The object of the Bureau is to ascertain and to present to the public important economic facts and the interpretation thereof in a scientific and impartial manner, free from bias and propaganda. The Board of Directors is charged with the responsibility of ensuring and guaranteeing to the public that the work of the Bureau is carried out in strict conformity with this object.

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6—A copy of any manuscript proposed to be published shall also be submitted to each member of the Board, and every member shall be entitled, if publication be approved, to have published also a memorandum of any dissent or reservation he may express, together with a brief statement of his reasons therefore, should he so desire. The publication of a volume does not, however, imply that each member of the Board of Directors has read the manuscript and passed upon its validity in every detail.

7—The results of any inquiry shall not be published except with the approval of at least a majority of the entire Board and a two-thirds majority of all those members of the Board who shall have voted on the proposal within the time fixed for the receipt of votes on the publication proposed; such limit shall be 45 days from the date of the submission of the synopsis and manuscript of the proposed publication, except that the Board may extend the limit in its absolute discretion, and shall upon the request of any member extend the limit for a period not exceeding 30 days.

8—A copy of this memorandum shall, unless otherwise determined by the Board, be printed in each copy of every work published by the Bureau.

NATIONAL BUREAU OF ECONOMIC RESEARCH, INC.

Incorporated under the Membership Corporation Laws of the State of New York, January 29, 1920

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RECENT ECONOMIC CHANGES

INTRODUCTION

By Edwin F. Gay

There is a measure of truth in the statement that the perspective of distance is analogous to that of time. The foreign observer imports his own preconceptions, and from the nature of his situation is likely to be inaccurate as to details, but he sees things in the mass. He generalizes on inadequate data, as must the historian, but it is often instructive to see through his eyes. What to the native is negligible matter of daily use and wont is lifted by the intelligent foreigner to the plane of a national characteristic or an important trend of social development. There have been many such travelers in the United States since the beginning of its history, and diverse have been their observations, but never has the flow of visitors and comment been so great as in recent years. Inquirers and writers from many countries, official and unofficial, literary folk and technicians, business men and representatives of labor, have come singly and in groups. During the last six or seven years, books, reports and articles, in many languages, describing, explaining or criticizing the economic and social situation in the United States, have appeared in unparalleled quantity. This has been heralded as the new Discovery of America.

Foreign Opinions.—Despite much divergence of opinion among these contemporaneous observers as to causes and conditions, there is marked unanimity as to the fact which is chiefly responsible for this extraordinary interest. They agree that of late there has been an "immense advance in America."[1] Our visitors are "impressed, everywhere and every day, by the evidences of an ebullient prosperity and a confidence in the future."[2] Even a skeptical Australian journalist who begins by doubting the very fact for which all other visitors are seeking the cause, namely the existence of high wages in the United States, ends by saying that "America has been experiencing a period of unusual industrial prosperity. Millions of people have found their earnings increasing at a more rapid rate than their standard of living."[3] The critical German trade-unionists, in their careful report, believe that American prosperity has within it the seeds of its later undoing, but they bear witness to the high earnings and effectiveness of the American worker, his mobility and freedom from class antagonism, and above all to the prevalent well-being and optimism of Americans in general.[4] A German industrialist declares that, with an economic supremacy characterized by high wages and machine progress, the United States has become "the first power of the world."[5]

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[1] Sir Josiah Stamp, *Some Economic Factors in Modern Life*, 1929, p. 121.

[2] Ramsay Muir, *America the Golden*, 1927, p. 1.

[3] H. G. Adam, *An Australian Looks at America*, 1928, pp. 35, 116

The consensus of foreign opinion concerning the present great American prosperity is evident to any student of this recent literature. But, though it might be interesting, it would certainly be a difficult and a time-consuming task to trace all the divergences of point of view and the differing degrees of emphasis as to the causes of that prosperity. Some of the travelers have returned home to spread the gospel of mass production, of automatic machinery and conveyers. But *Fordismus* and *Rationalisierung*, the slogans of these evangelists, have also been acrimoniously criticised. Ramsay Muir asserts, indeed, that "the methods of mass-production have not been introduced, and cannot be introduced, in the greater part even of American industry," but he elsewhere lays stress upon the factors of great natural resources and a great domestic free-trade market which have made mass production possible for the United States. England, by contrast, lives "by supplying the needs of world-wide markets, infinitely variegated," and must therefore make quality, not quantity, its aim.[6] Dr. Heinrich Ludwig complains that his German compatriots have, since the war, studied American industry too superficially. Ford, he declares, is not typical of the new management methods in the United States, and scientific management (*Rationalisierung*) has been misconceived in Europe as concerned primarily with mechanical equipment. It is not American technique but American psychology which should be studied. Its chief characteristics, he asserts, are optimism tempered by statistics and experiment; its aim is stabilization; the secret of American success is its study of the market.[7]

America has become the arsenal whence weapons are drawn for both sides of embittered argument. It is, for instance, to some European protectionists a demonstration of the benefits of a high protective tariff; to other writers it is a proof in its free-trade continental market of the correctness of the commercial principles urged by the *laissez-faire* economists;[8] and it is also a reinforcing support to the advocates of a

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[4] *Amerikareise deutscher Gewerkschaftsführer*, 1926, pp. 29, 48, 95, 193, 198.

[5] Carl Kottgen, *Das Wirtschaftliche Amerika*, 3rd edition, 1926, p. iii.

[6] Ramsay Muir, *op cit.*, pp. 73–76, 137.

[7] Heinrich Ludwig, *Systematische Wirtschaft, Amerikanische Methoden, Deutsche Verhaltnisse*, 1928, *passim*.

[8] Yves-Guyot, "Les États-Unis d'aujourd'hui," *Journal des Economistes*, Vol. 87, (1927) p. 15.

European *Zoll-Verein.* Its high wages are both the cause and the result of its prosperity.[9] The labor situation of the United States, so puzzling to the foreign workers who are surprised at the friendly working spirit in American labor-relations,[10] furnishes grounds both for attack and defense in respect to trade-union policy. Some observers emphasize American individualism,[11] others our spirit of co-operation, our "unconscious socialism,"[12] while one economist shrewdly remarks that the pioneer's struggle with the wilderness simultaneously developed both of these apparently incompatible traits.[13] We are assured that America is a land of contrasts, with great diversity of regions and races, and also that it is the home of a nation remarkable for its uniformity of tastes and its passion for standardization. Its people are massed increasingly in monotonous repetitive machine-labor; yet they show high intelligence and mobility in a free field for ambition. The condition of the farmer in the United States is called by Ramsay Muir one of the "spots on the sun" of the American heaven, and he thinks that in American agriculture, "there seems to be an arrest of development."[14] But a German writer, not less observant, works out a coefficient of welfare higher for the United States than for Germany on the basis of the fact that while in Germany 43.3 per cent of the gainfully employed are required to feed its population, in the United States 29 per cent suffices to perform the same service. The agricultural production per man in the United States, he states, is 2.46 times greater than in Germany. Not counting tractors and other agricultural machinery which have brought such an accession of power and wealth-production to the American farmer, in the item of horses alone he finds the number per agriculturist in the United States to be 3.7 times that of Germany. To him, agricultural America seems "a blessed country."[15]

It is needless to enlarge on the numerous clashes in the testimony of the foreign observers. It is more to the point to indicate that, despite their varying origins and predilections, there is a considerable degree of concurrence, although with differing emphasis, regarding certain main factors in the recent economic and social experience of this country. These factors may here be briefly summarized.

1. The natural resources of the United States are unrivaled, especially those which are fundamental to modern large-scale industrialism. There

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[9] Exponents, illustrating these contrasting views in the German pamphlet-war, are Tarnow, President of the German Woodworkers' Union, and the *Vereinigung der deutschen Arbeitgeberverbände.*

[10] See the Daily Mail Trade Union Mission to the United States, 1927.

[11] British Official Report, 1927, p. 15.

[12] Julius Hirsch, *Das Amerikanische Wirtschaftswunder*, 1926, p. 229

[13] Carl Köttgen, *op. cit.*, p. 56.

[14] Ramsay Muir, *op. cit.*, pp. 16–19.

[15] Carl Kottgen, *op. cit*, pp. 9–15.

is not only a continental width of fertile land, but there exist also marvelous deposits of coal, petroleum, iron and other essential minerals. The more critical of the foreign visitors are inclined to stress these bountiful gifts of nature, others weight more heavily the energy and organization which has utilized them.[16]

2. In this vast expanse of territory, historically so recently opened to European migration and settlement, labor is relatively scarce and wages are relatively high. The situation may be tersely stated, that "because American resources are abundant, they are wasted; because American labor is dear, it is economized."[17] In the present undeveloped state of international wage statistics, it is natural that estimates of the higher range of American wages should vary. André Siegfried, in his somewhat impressionistic manner, says they are "often ten times as much as those of even a European,"[18] while the more conservative German trade-unionists put the American wage level at about three times that of Germany and real wages two and a half times as high. But the European writers agree that there is in the United States a markedly higher standard of living and that this profoundly influences the American outlook.[19]

3. In consequence of the juxtaposition of rich resources and an inadequate labor supply, there has resulted a progressive development of labor-supplementing machine equipment, in agriculture, transportation and industry, and also a remarkable utilization of power. To some, this seems to be the chief explanation of the greater productivity of the American wage earner and hence of his higher standard of living.[20]

4. Many observers hold that of even greater importance than the technical progress is the great domestic market, untrammeled by barriers of tariffs, language, or tradition of local or national jealousies. The resulting "mass consumption" makes mass production possible and profitable. The nation-wide market necessitates expanding agencies of distribution which are highly remunerative to their originators and which

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[16] I quote once more from Ramsay Muir (*op. cit.*, p. 2): Once these resources were developed "by means of man-power drawn from Europe and capital largely drawn from England, nothing could prevent America from becoming the most prosperous country in the world . . . This is the main, and the abiding, cause of American prosperity. It cannot be imitated." Julius Hirsch, (*op. cit.*, p. 27) does not hesitate to make a numerical ratio between the factors of nature and organization. He ascribes about two-fifths of the greater American productivity to natural resources and three-fifths to higher efficiency.

[17] L. Chiozza Money, *L'Europe Nouvelle*, 1926, Vol. 9, p. 1528.

[18] André Siegfried, *America Comes of Age*, 1927, p. 160.

[19] *Ibid.*, p. 154. Siegfried asserts that the "enormously higher" standard of living in the United States is "now the chief contrast between the old and new continents."

[20] Cf. *The Economist* (London), Vol. 106, p. 522.

absorb a growing proportion of the gainfully employed.[21] The character of the unified American market frequently leads to foreign comment on its surprising uniformity of demand. The American business man, according to a French point of view, "has standardized the individual in order to be better able to standardize manufacture."[22]

5. The problem of correlating abundant resources, expensive labor, and unsurpassed machine equipment, to serve the greatest of markets, has put a high premium on management and organizing capacity. Scientific management in industry and commerce, apparently the resultant of emerging pressures, is thought by many of the foreigners writing on recent economic changes in the United States to be the chief contribution which this country is making to economic welfare and to be the key to its success. It is seen that the American effort is aimed at the "optimum" result, the proper balance of all the many factors in a business enterprise.[23] The preoccupation of the old-time manager with wages has given way to a concern for the manifold elements entering into unit costs. Such far-sighted management is becoming highly specialized; a new profession is entering into the structure of American industry.

6. In order to obtain the effective utilization of the worker's effort and to lower costs, American management has begun more systematically to improve industrial relations. It seeks to reduce the turnover of labor and the friction of labor troubles which disturb the smooth-running mechanism of industry. In a number of the larger concerns departments have been established to study and to deal with this problem, and this new specialization of personnel management has attracted favorable foreign attention. Some observers regard "the achievement of industrial peace between labor, capital and management"[24] as among the leading causes of American prosperity. But even those who speak in cooler tone agree that a great improvement in industrial relations has been effected. It is generally recognized that there has been a voluntary assumption by employers of heavy social charges in the establishment of benefits of various kinds, and there has continued since the war a considerable

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[21] The German trade-unionists remark that advertising, the appropriate tool for modern salesmanship in a wide market, is everywhere, in England, France, Germany and the United States, from 2 per cent to 5 per cent of the total cost of production. The larger absolute amount thus expended in the United States is due merely to the greater size of the market. But the size and uniformity of this market has led in the United States to more highly developed sales policies. (*Amerikareise*, p. 66.)

[22] Pichot and Fournier, "Communication sur le voyage aux États-Unis," *Bulletin de la Chambre de Commerce de Paris*, July 7, 1928.

[23] See especially the remarks of the German trade unionists, *Amerikareise*, p. 49.

[24] P. A. Molteno, "The Causes and Extent of American Prosperity," *Contemporary Review*, August, 1927.

interest in plans for workers' representation.[25] A corresponding shift in the labor-union attitude has also taken place which differentiates the American labor movement from that found in any other country. The new labor-union policy recognizes not the identity but the mutuality of interest between the two parties to the labor contract. This approach to better understanding on both sides is itself a sign of general change in the temper of the industrial community. The human aspects of the relationships of management not only with labor, but also with customers, competitors, and the public, are more stressed in word and in practice. There is a growing sense of social responsibility.

7. A related factor in American economic efficiency is the openmindedness of American management. Many visitors note with appreciation the freedom of access and information which they have found.[26] "What is raising the whole standard of management in the United States is the habit among employers of discussing their problems openly among themselves, of comparing the methods of one industry with those of another, and of founding associations for research and conference . . . They are not afraid to teach each other or too proud to learn from each other."[27] They are giving increasing support to scientific research and looking with respect upon university training.

8. Emphasis is unanimously laid upon the dominant national trait of optimistic energy, as an underlying element in these various phenomena of American economic activity. The individual in America is mobile as to place and calling; he is moving upward.[28] He sometimes appears docile, but it is because he is tolerant of social inconveniences which his experience tells him are only incidental and temporary. The way to education and to promotion is wide open; indeed many ladders to advancement are available and their rungs are all intact, so that he may climb who will. We are told that this is the inheritance of the frontier; in spite of the fact that the agricultural frontier has disappeared, our visitors find still strongly persistent the same characteristic spirit of indomitable hopefulness.

Historical Parallels.—To the historical student many of the links in this interlocked chain of causation will be familiar. At least the premises from which our later developments may logically be derived lie far back in the national history. The vast resources have stimulated American imagination since the earliest settlements on the Atlantic coast-line;

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[25] One of the best studies of the subject is H. B. Butler's report on *Industrial Relations in the United States*, International Labor Office, 1927.

[26] See, for instance, A. Detoeuf, "Les conditions de production américaine," *Revue politique et parlementaire*, Vol. 128; Carl Köttgen, *op. cit.*, p. iv.

[27] "American Industry and its Significance," *Round Table* (London), 1926, Vol. 17, pp. 264.

[28] On this point, note especially the testimony of the German trade-union report, which was based upon contact with American workers. *Amerikareise*, p. 95ff.

Washington, Hamilton, Gallatin and a long line of political leaders have voiced the national ambition for their exploitation. The visitors from Europe throughout the nineteenth century have constantly discerned the conditions of boundless opportunity limited by inadequate labor-supply which were the basic elements in the American economic problem, and they have described the same buoyant, experimental spirit moving toward its solution. Writers of the colonial period noted the competition to secure labor and its result in relatively high wages; they discovered that the rule imposed by the conditions of American agriculture, cheap land and expensive labor, was to make the goal not the greatest produce per acre, but the greatest product per man. The travelers of the early nineteenth century were struck by the skill, versatility, intelligence and ingenuity in mechanical inventions to be found among Americans of all ranks and conditions.[29] Mrs. Trollope, in 1832, conceded a grudging admiration for the "vast continent . . . and a busy, bustling, industrious population, hacking and hewing their way through it . . . nothing can exceed their activity and perseverance."[30] Early writers touched a note which later visitors, like Herbert Spencer, Matthew Arnold and Moritz Bonn, were to echo: "The mechanical arts are of necessity in constant progress, energy and ingenuity have ample scope, but the moral greatness of man is nearly undeveloped."[31] The elasticity and resourcefulness shown in time of business crisis was noted by Captain Marryat who witnessed the panic of 1837.[32] Later, just after the panic of 1857, Sir James Caird also wrote of the Americans: "though they may sometimes have a setback for a time, they will soon rebound and take a fresh start . . . there is plenty for all . . . The laboring population in America is not stable, it is a shifting, unsteady, improving, advancing mass."[33] Most of those who studied the United States before the Civil War, like those who came after, found a people imbued with a passion for work and regarding "business" not only as the absorbing concern of life but as the social activity most worthy of emulation and reward. To the cultured European, with his background of leisure as a social ideal, the concentration of Americans on their task of subjugating and organizing the continent has often appeared, naturally enough, to be at the best a regrettable undervaluing of higher faculties and at the worst a frantic, ignoble pursuit of money. But the settlers in this country, with their imported standards of living and their ethical tradition to uphold and strengthen in the face of formidable physical obstacles, were obliged to develop qualities that made not merely for survival but for the mastery of their environment.[34] With a supply of labor and capital always inadequate to meet the growing needs, they brought into play enhanced energy and alert ingenuity, and they eagerly seized and improved upon the new instruments of the Industrial Revolution. This was a one-sided development, for to them business became not a means to an end but an end in itself. But it became and has remained their greatest work of creative organization. Out of the historical necessities of the American situation have sprung the present economic structure, the social values and the peculiar national traits of the United States. Whether these have taken anything like a permanent mould it is too soon to say. It is certain that another century of development, under the altered conditions which the existing generation is witnessing, will blend new traits in the composite which is called national character. But prophecy's surest foothold is an intimate knowledge of past and present, and that knowledge as yet is not sure enough.

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[29] William Cobbett, *A Year's Residence in America*, London, 1818, Pt. II, p. 322; Pt. III, p. 528; Lt. Francis Hall, *Travels in* 1816 *and* 1817, Boston, 1818, pp. 176, 226; Fr. List, *Gesammelte Schriften*, Ed. L. Häusser, Vol. I, p. 148.

[30] Mrs. Trollope, *Domestic Manners of the Americans*, London, 1832. Vol. II, p. 136.

[31] T. C. Grattan, *Civilized America*, London, 1859, Vol. I, p. 104; Vol. II, p. 105.

[32] Captain Marryat, *A Diary in America*, 1839, Vol. I, p. 49.

[33] Sir James Caird, *Prairie Farming in America*, 1859, pp. 94, 117.

It has seemed worth while to place a few of the earlier travelers' observations beside those of the present time in order to emphasize the basic continuity of the American problem and of the economic and social organization which has been and is being evolved to meet its conditions. The present situation of the United States, remarkable as it appears to the inquiring stranger, may be regarded in future times as but one interesting stage in a lengthening series of somewhat similar episodes characterizing the economic history of this and other modern nations. The Industrial Revolution, of which this stage is a part, was not merely a sudden burst of industrial and commercial activity, occurring in England just before the threshold of the nineteenth century, and spreading by transmission or diffusion at successive intervals to other countries. It was rather a new organic growth, utilizing new powers over nature, and expanding over the world with an uneven but continuing acceleration. The external evidences of this growth we can visualize, but its inner processes we do not yet understand. The successive phases of its development we have only begun to analyze. In a living organism there are constant principles of change, could we but discover them, but there are, strictly speaking, no parallels—only general similarities. Each phase, though the fundamental processes of change are continuous, has its individual characteristics, its special direction and rate of movement, and its own "new" elements. Analogies must, therefore, always be accompanied by a warning proviso. Thus, when Ramsay Muir finds a likeness between "Detroitism," and early Victorian Manchesterism, he immediately adds that Detroitism is Manchesterism "adapted to new conditions."

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[34] Michel Chevalier, *Lettres sur l'Amérique du Nord*, 1837, Vol. I, pp. 56, 84; Vol. II, pp. 374, 377; Alexis de Tocqueville, *De la Démocratie en Amérique*, 4th Ed., 1837, Part II, Vol. I, p. 70; Vol. II, p. 205.

And so, when we look back over a century of our own economic history for analogous periods of fairly continuous advance, without too minute regard for the fluctuations of the business cycles, we find certain groups of years which have points of likeness, and also of unlikeness, to the experience of the United States since 1922. There have been four previous periods of efflorescence. These correspond approximately to increases in contemporaneous economic activity in Western Europe. The first of the four periods of marked acceleration set in about 1825, with the recovery from the great fall of prices which followed the end of the Napoleonic wars, and, although there was one sharp break in 1834, this period of activity culminated in the boom of 1836. Then came the prostrating panic of 1837, the western crisis of 1839, and years of depression. Again, from about 1849 to the panic of 1857, broken by a mild recession in 1854, there were successive years of unprecedented prosperity. Immediately after the Civil War there was a time of hectic prosperity and great speculative activity, but with too many disturbing factors to rank the stretch from 1865 to 1879 among the notable periods. But from 1879, through the "fat eighties," though with recessions, to 1893, we may find a third remarkable forward movement. From 1898 to the crisis of 1907 there was a fourth long run of prosperity. In this case, the period of severe depression following the crisis was remarkably brief, and the country had several years of undramatic fluctuations before the curtain rose for the tragedy of the Great War.

Two of these four major periods, the second and fourth, were accompanied by new gold discoveries and rising price trends; during the first period, from 1825 to 1837, prices were gradually falling, and the third, from 1879 to 1893, experienced a marked and steady drop in prices. All of them show remarkable advances in the exploitation of the national resources, notably land occupation in the first three periods; in the last three, coal, iron and petroleum production at an accelerating rate in a world comparison, gold and silver production at a diminishing rate; in the last two periods the other mineral resources, copper leading, come into greater prominence. With each forward surge the demand for labor has grown and immigration has responded. Despite a migration of colossal proportions, such as the world had never known, the demand for labor was nevertheless maintained. Each period saw an increase in real wages, though more lagging and less pronounced than that which we have recently witnessed. All four periods contributed notable inventions and methods for economizing and supplementing human labor. With developing pressure there was a difference in the main direction of technological advance, earlier toward transportation and horse-driven agricultural machinery, later toward industrial equipment and a great extension in the mastery and use of power. The steady growth of the vast domestic market led in each period to inevitable changes in marketing and credit organization; the "orthodox" system of distribution, with its wholesaler, local jobber, and retailer, was clearly under strain in the second period and beginning to break in the third, while new forms and relationships were being established. Each phase of activity is marked by development of the banking system to meet the demands of rapidly growing industry and commerce; and each concluding phase of crisis, 1837-1839, 1857-1860, 1893-1896, 1907, gave the impulse to banking and monetary reforms. The pressure of expanding markets and of technological opportunity was necessitating even more conspicuous transformations in factory organization and in magnitude of enterprise. These changes, with the exploitation of natural resources on an ever-enlarging scale, called into being successive groups of business leaders, often, at each first break into new fields of opportunity, sharp and unscrupulous, ruthless and daring. Beside the great merchants of the earlier period there swarmed the new growth which Charles Dickens pilloried, but out of their ranks came the outstanding personalities, organizers of industry and finance, the railroad and lumber "barons," the steel "kings," the meat-packing and oil magnates of the third period, and the leadership, more sobered by power and responsibility, of the fourth. Finally, throughout all the four great waves of advance, and even in the troughs between, there has always been felt that upward movement of forceful energy, of optimistic ambition, which our foreign observers have so constantly noted.

So rapid a sketch does but faint justice to the many and complicated aspects of our economic development, and it can only indicate the answer, if answer be at all possible, to the question of similarity between our present phase and those preceding it. Fuller studies, both qualitative and quantitative not only of business cycles but of longer trends, are required, and there is reason to believe that the interest which these studies are exciting will result in more exact knowledge even of earlier periods where the source material is relatively scanty. But it will serve our present purpose to point out that most of the eight significant features of the existing economic conditions in the United States upon which we have found our foreign visitors in substantial agreement are also characteristic of former major periods of prosperity in our history. The fundamental conditions of our existence on this continent have thus far remained substantially unchanged, and the responses have therefore been similar, not so much in external form as in their essential character. Even the successive maladjustments of economic growth show, behind their external dissimilarities, an underlying likeness. With superabundant natural resources, for example, we have always been open to the charge of wastefulness, and this is easily explicable, but with insufficient man power it seems, at first thought, curious that we are now and have ever been wasteful of human life. That we should permit the rate of accident and crime to remain so much higher than in other civilized nations may spring from the reckless forcefulness with which we have attacked the difficulties of expansion But there was a sign of change in the fundamental conditions of our national life when there emerged the conservation movement for the natural resources, and the slogan "safety first" for human life. Another serious maladjustment has been constantly observable in the extreme to which we have carried the swings of prosperity and business depression, the fierce bursts of speculative activity and the sharp reactions. Again, our environment and its needs may help to explain this feverish pulse-beat; yet here also another slogan, "stability," may be symptomatic of coming fundamental change. It is, furthermore, highly characteristic of all our periods of expansion that the rapidity and vigor of growth of some elements is so great as seriously to unbalance the whole organism. Each previous phase of prosperity has had its flourishing "new" industries, a different group each time, and each period has seen, or failed to see, other suffering members seeking readjustment or reduced to atrophy. With each successive advance, for instance, there has remained a farm problem and agrarian discontent somewhere in the rear. These rough dislocations in the past have made us exceptionally prone to scrap machinery and men. But quick adaptation and rapid mutation, perhaps biologically useful, our industrial society is now commencing to regard with more social concern.

The shiftings of psychological attitude, here indicated, seem to suggest that something distinctly different from our former experience is taking place. The chief characteristics of the present economic phase, agreed upon by our numerous visitors from abroad, are, it is true, evolved logically from what has preceded, and we are still finding answers along similar lines to a similarly constructed problem. But there seem now to be differences of degree which approach differences in kind. In this sense we may say that the unprecedented utilization of power and its wide dispersion by automobile and tractor, in which this country leads the way, is a new addition of enormous potentiality to our resources. With the general increase of wealth, the growth in the number of millionaires has been accompanied by a remarkable rise in the real wages of industrial workers, and a wide diffusion of investments. The profession of management is clearly emerging, and there is visible an increasing professional spirit in business, which springs from and entails recognized social responsibilities. The "self-policing" of business, with its codes of ethics, has been assisted by the recent development of trade-associations and the increasing influence of research and professional education. The strength and stability of our financial structure, both governmental and commercial, is of modern growth. The great corporate development of business enterprise, well marked in the fourth period of expansion, has gone on to new heights. It may be creating, as some think, a new type of social organization, but in any case the open-mindedness of the public, and of the state which is its instrument, toward this growing power of business corporations appears to be novel in American history.

Here are the beginnings of new answers to the old problem. But more than this. Some of the basic elements of the problem are evidently in process of change. The resources of the country, still enormous, are no longer regarded as limitless; the labor of the world is no longer invited freely to exploit them. The capital flow has turned outward; private and public interests and responsibilities have a new world-wide scope. These changes must have far-reaching consequences and entail further and more perplexing adjustments.

But with such prognostications as to the possibilities of the future, or with recommendations as to control of tendencies of which the symptoms seem now discoverable, the National Bureau of Economic Research is not concerned. As a purely fact-finding organization, it has been employed, with the enlistment of a staff of specialists, in bringing together in summary form the best information it could find as to the recent economic experiences of the United States. It has not undertaken to make primarily a study of business cycles for the years studied in this report, although a brief examination of the period 1922–1929 shows that the cyclical fluctuations have been notably moderate. The National Bureau believes that the range of social vision may be widened and the sense of direction in economic and social change may be surer as a result of such periodic surveys as it has been invited to make. The difficulty of such an undertaking is obvious. When even the visible variables are so numerous and so differently weighted, and when proportions and valuations are rapidly changing, judgment as to what is most significant is subject to error. The survey of a shifting, dynamic complex must for purposes of study and presentation be broken into its chief component elements and thereby the reality of the interlocking relationships of all the parts may be obscured. Yet the task, even though at best it can only be imperfectly executed, is worth trying. The attempt which has therefore been made, in the chapters which follow, to furnish as objectively as possible the materials for a study of the recent economic changes in the United States, is justified by considerations both of practical utility and of theoretical interest.

CHAPTER I

CONSUMPTION AND THE STANDARD OF LIVING

By Leo Wolman

I. THE STANDARD OF LIVING

The surprising sequence of events in the United States since 1922 has placed notions of the standard of living at almost the center of current economic thinking. The observed revolution in the things people buy and use in this country has directed attention to the neglected problems of consumption and has revived in a new guise traditional theories of economic progress. There are many now who are not content to describe changing standards but who find in them the source and mechanism of still further improvement. Although this way of looking at economic processes has had its widest currency here and is unquestionably in large measure a reflection of American conditions, it has had its repercussions abroad as well, and has in other countries won not only interest but also some assent.

In response to this persistent curiosity regarding the level of material well-being, considerable ingenuity has been employed in devising comparative measures of the rise or decline in prevailing standards of comfort. Since all inquiries of this nature do not proceed from precisely the same problem, they do not yield indexes of the same type. Those which are concerned with the relative changing status of the various classes of the population produce charts and tables showing the distribution of wealth and income among those who receive income and hold property. Others start with the question of the sufficiency of prevailing incomes of certain classes in the community to support a minimum, decent, or an American standard of life, and end with comparisons between the well-known ideal budgets, procurable at specified costs, and the incomes available for their purchase. Still others limit themselves to tracing the changing relation between income and the prices of the commodities people buy.

Measures of this last type are commonly known as real earnings, or money earnings corrected for changes in prices. They may be further described as measures of the purchasing power of money earnings. They purport, usually, to show the amount of a fixed budget that can, from time to time, be purchased with a given money income. They reveal the degree to which money income lags behind changing prices or precedes them, and are, accordingly, regarded as indicative of the losses or gains in material standards sustained by the members of various income groups.

Two elaborate recent indexes of real earnings in the United States illustrate the character and results of this type of measurement. Both cover the period beginning long before the war and ending somewhere in the postwar years. One[1] is limited to real earnings in manufacturing industries, the other[2] includes manufacturing, transportation, ministers, teachers, and public employees. While these two measures of real earnings differ radically in method of construction and in the materials they contain, both indicate the existence of a much higher level of real earnings after 1922 than had existed before, the new postwar level exceeding the heights of such peak years as 1916 and 1920.

Among individual manufacturing industries there are, as is to be expected, great variations in real earnings. Such variations as are shown are far from easy to explain and can probably be understood only in connection with the details of the economic and financial history of these industries during the period under discussion. For 20 of the 29 years, in the period from 1899 to 1927, the workers of the automobile industry, for example, were presumably below their 1914 level of real annual earnings, while both the steel and woolen goods workers were nearly always above that level. The rise of 38 per cent over 1914, achieved by the automobile workers in 1924, was exceeded by the woolen workers in 1923 and 1916, by the men's clothing workers in 1923, and frequently by the steel workers, notably in 1920, 1923, and since 1924. The discovery of variations of this nature may easily throw doubt on the validity of index numbers of real earnings as they are currently constructed and used.

There are, of course, many technical problems involved in sound discussion of measures of real earnings. But aside from that aspect of the matter there remains probably the more important question of the adequacy of such measures for the purpose in hand. It is certainly true that under some conditions, at least, the movements in real earnings are not a satisfactory barometer of the changes in the material standards of the people of a community. In the form in which it is generally used, the measure of real earnings represents the arithmetical relation between per capita or individual income and prices or the cost of living. While this relationship is unquestionably a significant one, both elements of the equation may be, and often are, defective.

The prevailing unit of economic life in the United States, and nearly everywhere else, is the family. The relation between individual earnings and family income is not known and is consequently not allowed for in most indexes of real earnings. This relation is, moreover, a variable one that has changed in the past and is likely to change in the future No method has yet been discovered for combining the various known individual incomes into a satisfactory family income, except that of the direct study in the field of the incomes of a limited number of families. Both individual and family incomes are in a large number of instances supplemented by other income, either from property or in the form of what are sometimes known as free goods—services furnished wholly or partially without cost by the state. It is, as will be noted later,[3] almost impossible to estimate accurately the flow of labor's income from property, but it is believed to be a substantial and increasing item, particularly in this country.

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[1] See Chap. VI, Labor, sect. 2, p. 433 and Chap. XII, National Income, p. 771. See also forthcoming census monograph by Paul F. Brissenden on real earnings in American manufacturing industries.

[2] Paul H. Douglas, "The Movement of Real Wages and Its Economic Significance," Supplement, *American Economic Review*, Vol. XVI, No. 1, March, 1926, p. 17.

Free income provided out of public expenditures, and also in increasing measure by private endowment, has become in modern times a factor of fundamental importance. In nearly all of Europe, state contributions to family income in the form of health and unemployment insurance, old age pensions, family allowances, and other gratuities of the same kind have grown to such proportions that it is no longer feasible or accurate to discuss real earnings without making proper allowance for these additions to private income.[4] While the United States has lagged behind other countries in this respect, the amount of such expenditure has without doubt risen in this country as well. Estimates of its volume cannot pretend to be complete, but they indicate the trend and the character of services so furnished.

Public Expenditures for Social Services.[5]—The data on public expenditures here included are in the main limited, by necessity, to the expenditures by the state and local governments whose financial statistics are contained in the reports of the United States Bureau of the Census on the financial statistics of states and of cities with a population of over 30,000. Some Federal appropriations, expended through the states and cities, are included in these figures. Certain types of private expenditures, particularly in the field of education, are, where they can be segregated and measured, also included. No hard and fast line can be drawn between public services that are social, and contribute to the well-being of the masses of the people, and those that are not. A case might, for example, be made for the inclusion of expenditures on highways, which in the 48 states rose from 23 cents per capita in 1915 to $1.35 in 1926 and in the cities with a population of over 30,000 from $2.06 in 1915 to

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[3] See Chap. VI, Labor and Chap. XII, National Income.

[4] For a most interesting discussion of this point see Henry Clay, "The Authoritarian Element in Distribution," *Economic Journal*, March, 1927, p. 1.

[5] The material for this section was prepared by Isador Lubin, of the Institute of Economics of the Brookings Institution.

$3.73 per capita in 1926. The total expenditure for this purpose from these two sources in 1926 was nearly $300,000,000 and it is steadily mounting. These figures were, however, omitted. Expenditures, likewise, for sewers and sewage disposal, street cleaning, refuse collection and disposal were omitted, although they amounted for the cities in 1925–26 to $124,000,000. The expenditures included in this discussion are those incurred for education, charity, recreation, and health and sanitation.

Of these social services, education not only absorbs the greatest income but it appears to be growing at a much more rapid rate than the rest. The gross expenditures for this purpose are estimated to have increased from three-quarters of a billion in 1913–14 to two and three-quarters billions in 1925–26. The details are shown in Table 1.

TABLE 1.—ESTIMATED EXPENDITURES FOR EDUCATION IN THE UNITED STATES

(In thousands of dollars)

	1913–14[a]	1914–15[b]	1917–18[c]	1921–22[d]	1925–26[e]
Public elementary schools (including kindergartens)	486,167	530,320	[f]599,383	[g]1,163,374	[h]1,328,396
Public high schools	68,911	75,141	162,876	417,297	697,912
Private elementary schools	52,042	51,683	[i]54,989	[i]77,398	[i]135,680
Private high schools	14,572	14,590	34,025	32,808	54,909
Other private and public secondary schools	13,501	12,746			
Universities and colleges:					
Public	[j]95,154	[j]101,753	[j]65,316	128,117	174,481
Private			[j]71,739	144,698	232,919
Normal schools	15,086	15,885	20,415	20,649	28,437
Teachers colleges	[k]	[k]	[k]	18,145	33,374
Commercial and business schools	8,403	9,164	24,572	[k]	[k]
Reform schools	8,654	9,039	10,158	18,953	[l]22,304
Schools for deaf	4,169	4,235	5,135	9,530	8,053
Schools for blind	2,477	2,618	2,932	2,894	[l]3,838
Schools for feeble-minded and subnormal	8,753	11,209	4,567	15,094	[l]18,364
Government schools for Indians	3,818	3,852	3,328	5,894	5,392
Total	781,707	842,235	1,054,851	2,054,851	2,744,059

[a] Data from United States Department of Interior, Bureau of Education, *Report*, 1916, Vol. II, p. 9.

[b] *Ibid.*, 1917, Vol. II, p 9

[c] Data from United States Department of Interior, Bureau of Education, *Bulletin*, 1920, No. 31, *Statistical Survey of Education*, 1917–18, p 5.

[d] *Ibid.*, 1924, No. 38, p 2

[e] *Ibid*, 1928, No. 12, p 8

[f] Includes schools for feeble-minded

[g] Includes city normal schools, city schools for deaf, city schools for feeble-minded and subnormals, and city evening schools.

[h] Includes city schools for deaf and city schools for feeble-minded and subnormal.

[i] Includes kindergartens

[j] Includes professional schools.

[k] Data not available.

[l] Year 1927.

Some of this does not represent free education. American universities and professional schools spent in 1925-26, $407,400,000, of which $101,499,000 was returned to them in the form of tuition and fees.[6] Of the $190,589,000 spent by private elementary and high schools it can only be estimated that from one-third to one-fourth was not covered by tuition receipts. What evidence there is appears to indicate that roughly $2,500,000,000 of the total spent on public and private education in the United States in 1925-26 represents free education. The per capita expenditures for pupils in the public elementary schools in 1926 were $63.31; in public high schools, $195.74; and in universities and colleges, $423. Total expenditure for education increased by 250 per cent between 1913-14 and 1925-26.

Almost half of this increase was for free elementary schools. At the same time enrollment in elementary schools rose from 17,934,000 in 1913-14 to 20,984,000 in 1925-26, or about 17 per cent. There has consequently been a great increase in the expenditure per child.[7] The striking increase in expenditure for education, however, took place in the appropriations for high-school education. They increased tenfold from $68,911,000 in 1913-14 to $697,912,000 in 1925-26, while the total enrollment increased by more than 200 per cent from 1,218,000 to 3,757,000. The number of college and university students likewise grew with great rapidity from 325,219 to 822,895 during the same period. It is estimated that the expenditure for free college and university education increased in little more than a decade by nearly 350 per cent.

Compared to the amount spent on education, the expenditures on libraries, exclusive of buildings, were very small and amounted, according to estimates of the Library Association, to $35,347,156 in 1926. Estimates of the United States Bureau of Education place the amount spent on libraries in 1913 at $15,780,000, so that per capita expenditures for this purpose have risen 87 per cent since before the World War.

Recreation accounted for public expenditures in 1926 of more than $50,000,000 which represented an increase over 1913 of 146 per cent. In the conservation of health, including outlays for the prevention and treatment of communicable diseases, particularly tuberculosis, for the conservation of child life, and for such sanitary and health work as the provision of free antitoxins, the known public expenditures of states and cities rose from $22,000,000 in 1915 to $57,000,000 in 1926. The greatest increase in this category was in the appropriations for the conservation

[6] Estimate of the Bureau of Education, United States Department of Interior.

[7] One item in the rapid increase in the total expenditures of recent years has been the increase in the amount expended for grounds and buildings and contents. Annual capital outlay per pupil in average daily attendance amounted only to $7 from 1916 to 1918. By 1925 this amount had increased to $21.86 and stood in 1926 at $20.47. United States Department of Interior, Bureau of Education, *Bulletin*, 1928, No. 12, *Statistical Survey of Education, 1925-1926.*

of child life. It should be pointed out, however, that these figures do not include all Federal appropriations for sanitation and public health. Federal expenditures in 1926 for all health purposes amounted to $131,000,000,[8] but of this $118,000,000 went to the United States Veterans' Bureau.

The combined expenditures by the larger cities and the 48 states for hospitals were $144,819,000 in 1926, of which the states spent $106,000,000 and the cities $39,000,000. But this amount covers a relatively small fraction of the total spent on free hospital service in the United States. An estimate made by Dr. Louis I. Dublin[9] places the aggregate cost of maintaining general hospitals for the physically ill in the United States at about $500,000,000 a year. The income of these hospitals from patients is estimated to cover roughly two-thirds of their total expenditures. The sum of $166,000,000, therefore, measures the free services of these hospitals. It is estimated further that, of the total expenditures by states and cities, $42,000,000 were spent for general hospitals and more than $100,000,000 for institutions for the insane. Something more than $120,000,000, therefore, of the income of general hospitals must have come from private endowments and contributions.

Public expenditure for charity is, in this country, not large. The statistics are again limited to the 48 states and larger cities, but, within this group, include the cost of caring for orphaned children and the blind, deaf, and mute, together with expenditures for outdoor poor relief, the support of poor in institutions, and other charities. The total amount so spent was $34,000,000 in 1915 and $58,000,000 in 1926. Small as this total is, it is not surprising, since the distribution of charity is, in the United States, almost exclusively the function of private agencies.

The remaining item, mothers' pensions, is reminiscent of European practice. Almost the newest form of public social service, the total expenditure for this purpose was nearly $13,000,000 in 1926, of which more than $2,500,000 was made by the states and slightly more than $10,000,000 by the larger cities of the country. Nearly 80 per cent of all outlays for mothers' pensions is made by cities with a population of over 500,000. The statistics for cities do not include this item previous to 1919, but the cost before that time was slight, since the total expenditure by the 48 states for this purpose amounted in 1915 to only $108,000.

It has already been pointed out that these measures of expenditure for social services are, in the main, limited to the outlays by the 48 states and the larger cities of the country. Except for education and libraries, no attempt has been made to estimate either the expenditure of the smaller cities or the amount of free services that flow from private sources.

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[8] James A. Tobey, *The National Government and Public Health*, Studies in Administration, The Institute for Government Research, 1926, p. 353.

[9] "What Price Doctors?" *Harper's Magazine*, November, 1927.

It is highly probable, therefore, that these figures grossly underestimate not only the absolute amount of such free services but also the rate of increase during the past decade. Even with these omissions, however, the total expenditures, shown in Table 2, appear to be an item of great significance in the income of the citizens of the country.

TABLE 2.—TOTAL EXPENDITURES FOR FREE SOCIAL SERVICES BY 48 STATES AND CITIES WITH A POPULATION OF OVER 30,000

Service	Expenditure	
	1915	1926
Education	[a]$708,164,000	[a]$2,499,000,000
Libraries	[a]15,467,000	[a]35,874,000
Recreation	21,295,000	53,969,000
Conservation of health	21,950,000	56,357,000
Hospitals	58,005,000	144,819,000
Charities	34,347,000	58,211,000
Mothers' pensions	[b]108,000	12,705,000
Total	$859,336,000	$2,860,935,000

[a] These figures include estimates of expenditures from private sources, after deducting for the payment, in the case of educational institutions, of tuition and fees

[b] This figure does not include city expenditures, for which there are no 1915 data.

This imperfect estimate of the amount spent for free social services shows a rate of increase over ten years much greater than either the rate of growth of the total population or of the national income. The estimates of expenditures for free services constitute 2.4 per cent of the estimated national income in 1915 and 3.4 per cent in 1926.[10]

Hospital Facilities.[11]—The great advances constantly made in this country in the facilities serving the interests of health, only noted in passing in the preceding discussion, are strikingly described in the available statistics of hospital service.[12] The record of growth of the number of hospitals and beds, presented in Table 3, shows an increase in these facilities far more rapid than the increase of population. While these total facilities are not free, there is no reason to believe that the proportion of free service has not increased pari passu with the growth of total facilities. The marked growth in the number of state and Federal hospitals and in the number of beds added would appear to confirm this belief.

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[10] The estimates of national income here used are those made by the National Bureau of Economic Research.

[11] The material for this section was prepared by Homer F. Sanger, of the Council on Medical Education and Hospitals of the American Medical Association.

[12] Unless otherwise indicated, the statistics in this section are based on reports of the Council on Medical Education and Hospitals of the American Medical Association.

TABLE 3.—GROWTH OF HOSPITALS, 1909 TO 1927[a]

Year	Federal hospitals		State hospitals		Other hospitals		Total	
	Hospitals	Beds	Hospitals	Beds	Hospitals	Beds	Hospitals	Beds
1909	71	8,827	232	189,049	4,056	223,189	4,359	421,065
1914	93	12,602	294	232,834	4,650	287,045	5,037	532,481
1918	110	18,815	303	262,254	4,910	331,182	5,323	612,251
1923	220	53,869	601	302,208	6,009	399,645	6,830	755,722
1927	301	60,444	592	354,786	5,914	438,088	6,807	853,318

[a] These statistics regarding hospitals include the hospital departments that are sometimes maintained by institutions, such as prisons and custodial homes, for the care of sick or injured inmates or occupants. In 1923 there were 767 such hospital departments with an average census of 24,926; by 1927 they had been reduced to 530 departments having an average census of 21,930 patients.

From the date of earliest record, the number of hospitals has increased rapidly and with remarkable regularity until 1923, after which there appears a slight decrease in the number of hospitals but the usual increase in capacity. Taking into account the decrease of 237 hospital departments from 1923 to 1927, there must have been a gain in the number of actual hospitals. Measuring the growth by the number of beds added annually, the rate has been almost uniform, or a net gain of roughly 25,000 beds a year, at least from 1909 to 1927.

Not all hospitals are available alike to all the sick and injured of the community. Some are restricted to Government or other limited classes of beneficiaries, such as those of the Veterans' Bureau, the Army, Navy, and Marine hospitals, or the state nervous and mental institutions. The growth of community hospitals, institutions that are open to the whole community, is a more useful index of the available hospital capacity of the country. The number of such hospitals has increased from 4,013 in 1920 to 5,639 in 1928, and their capacity in the same period from 311,159 to 442,913 beds. The important feature of this growth is that it has been widespread and has progressively meant the creation of hospital facilities where none existed before. Thus, the percentage of the 3,076 counties in the United States that have hospital facilities increased from 44.0 in 1920 to 57.4 in 1927. Much of this development has occurred in what were probably the backward areas of the country. In 1920, 25.4 per cent of the counties of Alabama had hospitals and by 1927 this percentage had risen to 53.7; in Arkansas the rise was from 24.0 to 42.6 per cent; in Georgia from 18.4 to 30.4 per cent; in Mississippi from 26.8 to 45.2 per cent; in Oklahoma from 35.0 to 51.9 per cent.

Probably the most illuminating index of the growth of hospital facilities is the ratio of population to the number of beds for community use. This ratio in the country as a whole and in the main geographical divisions is shown in Table 4. In 1920 there were 340 persons per bed

TABLE 4.—RATIO OF POPULATION TO BEDS

Geographical division	1920	1925	1927
Total United States	340	291	270
North Atlantic	242	216	198
South Atlantic	508	407	430
North Central	355	301	267
South Central	705	544	508
Western	211	218	209

as contrasted with 270 in 1927.[13] It is interesting to note that Wisconsin has the lowest ratio of population to beds, closely followed by Nevada, Colorado, and California, and by New York, Massachusetts, and New Jersey. The states showing the highest ratio are South Carolina, Oklahoma, Georgia, Arkansas, Mississippi, Alabama, and Kentucky.

The growth in the number and capacity of American hospitals has been accompanied by a marked increase in their efficiency. Measured by such intangibles as the improvement in medical education and the rise in the standards of the medical profession, the progress in efficiency has unquestionably been great. But measured, also, by such objective factors as the amount of hospital equipment, the advance has been equally great. The following tabulation shows the increase in the past five years in the number of clinical laboratories and of X-ray departments in hospitals:

	1922	1927	Per cent increase
Hospitals reporting clinical laboratories	3,035	4,357	43
Percentage of all hospitals	44	64	
Hospitals reporting X-ray departments	2,841	4,387	54
Percentage of all hospitals	42	64	

There were at the same time 2,091 physical therapy departments reported in hospitals in 1927, the total beds in those hospitals numbering 354,019. Equal progress has marked the introduction of occupational therapy, social service, dietary, and other departments.

The acquiring of these facilities means more than the buying and setting up of so much machinery. It means the planning and construction of new buildings; the remodeling and enlargement of existing plants; and the addition of thousands of scientifically trained persons to operate these departments. And the growth has been not only in the new facilities, but also in the expansion and improvement of departments already in use.

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[13] Estimates of state population were based on estimates of the United States Bureau of the Census. Wherever available, figures from state censuses were used, since the state figures are of later date.

The Cost of Living.—The second element in the formula of real earnings is the cost of living. The ordinary measure of the cost of living is the weighted average of the retail prices of the many commodities and services that constitute the budget of the persons or group whose income is being studied. As such it is inevitably composed of many arbitrary elements. It is by its nature a rigid index, not sensitive to changes in people's ways of living, and like all indexes of prices or of production it cannot allow for such changes in quality as are frequently tantamount to reduced or increased expenditure. Such measures have their rough uses. But the conclusions to be drawn from them require confirmation from other and different sources.

Aside from these technical reflections on the nature of measures of real earnings, there remains still the fundamental methodological problem, whether simple arithmetical formulæ of this sort can always be expected to throw light on radical changes in material standards within a single country, or on the differences between prevailing standards in two or more countries essentially unlike in their manner of living. The problem has confronted many investigators and has frequently been settled by resorting to new devices of observation and measurement. In general, these devices have consisted in picking objective standards of living such, for instance, as housing facilities and in noting changes in the quality and amount available for specified groups of wage earners, salaried workers, or unskilled laborers;[14] or in studying directly the facts of consumption; or in discovering phenomena that are easy to find and measure and that are suspected of reflecting improved or lowered material standards.

In their survey of conditions in England, the Committee on National Debt and Taxation was faced with a problem of precisely this nature. Their method of stating their conclusions is, consequently, of interest in this connection. "Pure statistics as to resources on the one side . . . and as to savings on the other," the committee writes,[15] "might lead to a tentative inference that, if anything, rather less was being spent on the average; this would imply that . . . the average standard of living was lower than before the war . . . It is easy to let the comparative figures for rates of wages . . . have too much influence on the mind . . . Further, if adequate statistics as to consumption were available, it seems likely that they would be quite inconsistent with any lower standard of living . . . Altogether, in the present rather conflicting state of the evidence to be drawn from the statistics, we find ourselves thrown back, as a matter of common sense, upon the evidence of our own and other people's observations . . . For our part, we think that the signs of improvement, which have impressed many observers, are convincing, although it is doubtless possible to rate them too high."

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[14] See in this connection A. L. Bowley and M. H. Hogg, *Has Poverty Diminished*, London, 1925, and L. Houghteling, *The Income and Standard of Living of Unskilled Laborers in Chicago*, Chicago, 1927.

[15] Cmd. 2,800, London, 1927, pp. 11ff.

TABLE 5.—DEATH RATES PER 100,000 FOR TUBERCULOSIS OF THE RESPIRATORY SYSTEM

Year	U. S. Registration states of 1900		Metropolitan Life Ins. Co., Industrial Dept.			
	Males		White males		White females	
	Age 25 to 44 years	Age 45 to 64 years	Age 25 to 44 years	Age 45 to 64 years	Age 25 to 44 years	Age 45 to 64 years
1900	275.4	249.5	..		....	....
1910	248.5	242.5	.	...	...	..
1911	[a]	[a]	481.1	408.4	264.8	145.8
1912	[a]	[a]	455.8	387.8	239.8	135.8
1913	[a]	[a]	447.2	414.2	222.2	132.2
1914	[a]	[a]	445.0	434.5	218.1	136.6
1915	[a]	[a]	410.2	401.1	211.0	135.0
1916	[a]	[a]	390.4	397.3	205.2	122.4
1917	[a]	[a]	389.9	408.4	195.7	121.6
1918	[a]	[a]	356.0	393.0	203.7	119.6
1919	[a]	[a]	275.4	308.0	184.6	109.3
1920	154.1	165.6	209.5	244.3	162.2	97.3
1921	128.6	146.4	172.6	203.0	130.8	81.8
1922	126.1	143.9	174.9	217.2	127.0	80.8
1923	123.6	142.5	176.5	211.1	124.5	81.4
1924	118.5	132.6	157.8	197.2	113.2	74.0
1925	112.9	134.4	149.6	189.0	106.5	67.0
1926	112.1	137.2	148.7	198.6	101.0	67.4

[a] Data not available.

Many students of the standard of living have noted the persistent connection between prevailing economic conditions and the ebb and flow of mortality and morbidity rates. The specific cases of diseases arising out of undernourishment are well known.[16] The relation between infant mortality and economic insufficiency may not have been proved beyond a reasonable doubt, but its existence is generally conceded by students of the subject. Likewise the astonishing drop in the American death rate for tuberculosis after 1917, shown in Table 5,[17] is regarded by many as convincing evidence of the existence of improved material standards

[16] See section on Food Consumption, pp. 24–51.

[17] Prepared by Dr. A. J. Lotka, of the Metropolitan Life Insurance Co.

among American workingmen in the form of better housing, fuller nourishment, greater leisure, and a higher level of medical care.[18]

Consumption.—The use of statistics of consumption as measures of changing material standards also involves problems of great complexity. It is not always possible to find a satisfactory unit of consumption, since monetary units involve difficulties here as elsewhere. The problem of dating changes is, as will be seen later, not always soluble. Nor can statistics of consumption be so classified as to permit the allocation of the total amount of any commodity used by everybody among the various economic classes in the community. The best that can be done, under the circumstances, is to judge, from the sheer magnitude of the recorded change in consumption, how far it could have occurred without general participation in it. Making such judgments is often practicable; but where it is not, there is no easy way out.

The following brief and tentative surveys of the use of food, manufactured goods, automobiles, and housing in this country point at least to one useful and important conclusion. They all indicate such radical modifications in the habits of American consumption in recent years as to invalidate the results obtained from budgetary studies made before these changes had become effective. It is clear that fresh studies of family consumption would not only correct erroneous impressions, but might also, if properly made, throw light on the sources and magnitude of prevailing family incomes, a matter with regard to which we are still much in the dark.

II. FOOD CONSUMPTION[19]

National statistics of food production, stocks, consumption, and wastes are limited, defective, and difficult to interpret. Still more so is the information bearing on different groups within the population, and on the psychological factors in food consumption. Accordingly it is necessary, in discussing recent economic changes in respect to food requirements and consumption, to speak mainly in terms of trends and tendencies.

The Problem of Malnutrition.—A fundamental question is the extent and trend of malnutrition or undernourishment. These terms, here used interchangeably, apply to a condition which may be due to physical defects, disease, methods of eating, or psychological factors. Much of it is owing either to ingestion of too little food or to diets that are

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[16] For a discussion of this problem see "Economic Status and Health," *Public Health Bulletin*, No. 165, Treasury Department, Washington, 1927, particularly pp. 10, 13, 15, 67.

[19] This section is printed substantially as it was written by Joseph S. Davis, director of the Food Research Institute, Stanford University, California, assisted by Dr. Alonzo E. Taylor and other colleagues.

qualitatively unsatisfactory for proper nutrition. Certain well-known diseases (beri-beri, scurvy, and rickets) are caused, wholly or in part, by dietary deficiencies. Even where these do not result, malnutrition tends to increase the incidence of disease, to raise the mortality rate, to impede normal physical growth and development, and to reduce ability to work.

No country is without its ill-nourished class, which is by no means restricted to the poor; but the extent of the class and the degree of subnormality vary greatly from country to country. Judged by either test, the United States has probably never ranked low among the nations. But we have no means of measuring either the present extent of malnutrition or the degree to which it has increased or declined. It would appear, in the light of our present knowledge of nutrition in its relation to health, to be much more prevalent than had formerly been supposed. It is especially prevalent, and often especially serious, among pregnant and nursing mothers, and in infancy and childhood. With periodic health examinations, especially among children, increasingly common, more frequent, and more searching, more malnutrition is detected than formerly. Nevertheless, there is reason to believe that, on the whole, the trend has been downward in recent years until the present extent is smaller than before the war. But one must be content with inferences and indications; conclusive evidence is not readily available.

According to the newer knowledge of nutrition, dietary deficiencies resulting in malnutrition and disease are more largely due, at least in the United States,[20] not to calculable inadequacy in total calories or to shortage in intake of either proteins, carbohydrates, or fats, but rather to more insidious defects that have but recently been analyzed.[21]

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[20] This is not universally true. J. B. S. Haldane, a prominent biochemist, may be right in saying, in his recent essay on "Vitamins" in *Possible Worlds and Other Papers* (New York and London, 1928), p. 59: "as a matter of fact, about half the human race at the present moment is suffering from partial starvation, and the first requisite for them is to eat more of the cheapest food they can get, vitamins or no vitamins."

[21] Studies of farm diets were made by Funk in 1912–1914, covering 950 families in 14 states, and by the United States Department of Agriculture in 1922–23, covering 1,331 families in Kansas, Kentucky, Missouri, and Ohio, and in 1923–24, covering 86 families in Vermont. These all showed that, on the average, food consumption apparently exceeded liberally calculated requirements by much more than probable wastage. This was true of each of the five elements separately calculated—energy, protein, calcium, phosphorus, and iron. Cf. preliminary report on the second study, by Edith Hawley, (mimeographed), United States Department of Agriculture, *Average Quantity, Cost, and Nutritive Value of Food Consumed by Farm Families*, August, 1925, and her preliminary report on the Vermont material, January, 1927. Dr. Hawley's analysis of the data collected for urban diets in workingmen's families, by the United States Bureau of Labor Statistics in 1918–19, showed, on the contrary, a substandard average in total calories and in all the elements studied except protein. Closer analysis of the wastes, the number of meals bought in restaurants, and other factors, however, might yield different results.

The body requires food proteins out of which it can reconstruct the proteins of which it is largely composed. Many diets contain too little protein, or proteins of inferior quality. The lack of sufficient quantities of certain mineral salts in appropriate combinations is another insidious cause of ill nourishment, resulting in impairment of health or fertility. Common methods of protection against infestation and decomposition reduce the vitamin content of foods, and higher standards of palatability often make for a constipating diet.

It is clear that the causes and corrections of malnutrition are by no means wholly economic. However, certain economic tendencies of the past century, such as increased congestion of population, the decline in home gardens, and the increased availability of cereals, potatoes, and sugar, have tended in the direction of dietary deficiencies in minerals and vitamins. With increased income per capita, moreover, there has been a decreased demand for those portions of cereal grains and animal carcasses which possess nutrients of the greatest dietetic value. The corrections lie partly in making generally available the foods that contain certain elements of which shortages tend to occur, and partly in more widespread understanding of the body's requirements as obtainable from foods.

In both these respects there have been notable gains in recent years. Our knowledge of nutrition has greatly increased, and the knowledge is much more widespread than ever before. Instruction in food values, proper diets, and related phases of home economics, together with physical examinations and advice in schools and clinics, tend to reduce the amount of undernourishment that can be avoided by proper use of available resources. The increased availability, throughout the year, of fresh milk, fresh vegetables, and fresh fruits (which are excellent sources of essential but often slighted food elements), together with higher levels of income which have brought these within reach of nearly all classes, have contributed greatly to more adequate consumption of the "protective" foods and the consequent improvement of the diet in the nutritional sense. Improved sanitation and inspection, together with wider knowledge, have reduced the prevalence of germ transmission by food. Higher incomes have also reduced the prevalence of insufficient food. The gains have inured most to the urban populations, among whom dietary deficiencies have been most common, but they have been shared by considerable portions of the rural population as well. For the most part, such ill nourishment as persists is owing proximately to mismanagement of income, through ignorance or otherwise, or to low income as such.

Subnormal nutrition has probably been commonest among recent immigrants from countries with low food standards, in rural and urban negro population groups, in large families of the lower-income groups of wage earners and salaried employees, and where a large proportion of low incomes was spent for liquor. Immigration restrictions, negro migration to the North,[22] lower birth rates, and prohibition combined have tended to reduce these causes making for inadequate or unbalanced food consumption. The increasing mechanization of manufacture, transport, agriculture, and construction has reduced the demand for unskilled labor, and increasing opportunities for education and training have made it possible for the younger generation of these groups to move into higher wage classes.

Declining Food Requirements per Capita.—For many years there has been a significant and practically continuous trend toward smaller food requirements per capita—in the physiological sense, not the economic. This has been especially the case in the United States, and the tendency has become more pronounced in recent years.

This decline has occurred largely in energy-producing foods, and chiefly in the quantities needed to maintain body heat and furnish energy for active work. There are no indications of appreciable change in the individual requirements for mineral salts, vitamins, and proteins for tissue replacement, or in the energy requirements for carrying on the simple bodily functions. The physiological requirements for growing children have not changed, except as they may be affected by increased activity in sports and by changes in clothing and heating.

Some change in the national per capita requirement for maintenance and growth may have occurred through alterations in the age and sex distribution of the population. Declining rates of infant and child mortality tend proximately to increase the proportion of growing children, but declining birth rates and increasing average longevity of adults tend to increase the proportion of more elderly persons. The net effect of these and other factors may be to decrease the proportion of persons in the age groups (over 11 and under 45) which require more than the average amount of food for purposes other than heat and activity. This was probably true between 1910 and 1920, judging from the census data, but it may not prove equally true for the decade 1920–1930. A decline in the proportion of males to females, such as occurred between 1910 and 1920, makes for reduced per capita food requirements, since in general the female requirement is lower than the male; but the change shown by the census of 1920 was probably owing mainly to reduced immigration and the outflow of former immigrants in connection with the war, and the postwar net inflow of immigrants, despite immigration restrictions, may have prevented a continuance of this decline.[23]

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[22] It is reported that the diet of negro workers on southern plantations has been improved in consequence of higher pay and better conditions, established in the effort to resist depletion of the labor force. Cf. *Journal of Home Economics*, September, 1926, Vol. XVIII, pp. 523–525.

There is probably some reduction in characteristic body weights, to judge from observations of physicians, life insurance companies, and clothing manufacturers and sellers, and the well-known vogue of the slender figure in the case of women. Since it takes less food to attain and maintain lighter body weights, this has probably had some influence in reducing food requirements for storage of fat in adults and for maintaining body weights.[24]

The net effect of these factors has probably been to reduce per capita requirements. It seems clear, however, that the major influence has been exerted by factors making for reduced intake of food-fuel required to furnish working energy and maintain body heat. These factors have arisen out of changes in the conditions of labor and methods of living of the American population, which have been particularly in evidence during the past decade. A few of these factors require special emphasis. The changing proportion of labor in exposed and sheltered occupations, which has been under way for generations, continues now with the movement out of agriculture into the clerical and professional occupations. The progressive mechanization of industry and agriculture has in this latest period revolutionized those occupations requiring the greatest physical exertion. Since 1914 the reduction in the hours of work has been made at more rapid rate than ever before. The widespread use of the automobile, with the rising popularity of the closed car, has hardly been offset by the growing disposition of Americans to indulge in outdoor sports. Finally there has been a decided improvement in the equipment of both industrial and domestic housing that has tended to effect a material conservation of body heat in colder regions and in colder

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[23] The following tabulation, from the population census of 1920 (Vol. II, p. 155), is of interest in these connections:

Age group	Percentage distribution, both sexes		Males to 100 females	
	1910	1920	1910	1920
Under 5 years	11.6	10.9	102.5	102.5
5–14 years	20.5	20.8	102.0	101.9
15–24 years	19.7	17.7	101.0	96.8
25–34 years	16.5	16.2	109.0	102.1
35–44 years	12.7	13.4	111.8	108.9
45–54 years	9.1	9.9	115.7	116.7
55–64 years	5.5	6.2	112.4	112.8
65 years and over	4.3	4.7	101.1	101.3

[24] The reverse has apparently occurred in Germany, where, under stress of restricted food supplies, average body weights declined during the war, and where in postwar years there has been a noticeable tendency to return to the former heavier weights.

weather.[25] The only significant offsetting factor has been the tendency toward lighter clothing

As a result, the reduction in per capita requirements of food, though not susceptible of calculation, must clearly have reached substantial amounts. While the various factors mentioned have been operative for many years, there have probably been few decades, if any, in which they have exerted a greater influence than in the ten years since the end of the World War.

Measurement of Food Consumption.—It is out of the question, at present, to arrive at an accurate measure or even, for most commodities, a convincing statistical demonstration of the reduction in calories consumed per capita, to say nothing of following its course year by year. In tracing foodstuffs from origin to final consumption, enumeration and measurement are lacking to a surprising extent.[26]

Even if food production could be measured, it would not afford an effective measure of ingestion. The caloric content of certain foods, such as meats, varies somewhat with the character of the product—the relative weight of bones, fat, etc. Despite important improvements in recent years, statistics of stocks are far from adequate and dependable. The proportion of waste is variable to a material extent, and a large element of variation occurs in the household itself as well as in channels of distribution; and on food wastes our information is extremely limited and defective. Conclusions as to dietary changes must rest, in large measure, upon skillful observation and inference as well as upon carefully interpreted quantitative data. The conclusions here expressed, even when not explicitly tentative, must be regarded not as definitive but as subject to modification.

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[25] See Housing, Chap. III, Construction, p. 233; and Chap. V, Marketing p. 324.

[26] Even with respect to production, the censuses of agriculture and manufacture have been incomplete or otherwise untrustworthy, and in different degrees from census to census and from commodity to commodity. The agricultural censuses before the war were almost primitive in character. The decennial census of 1920 was taken during a period of transition from war to peace. The biennial censuses of manufacture since the war have been unsatisfactory in respect to many classes of food supplies. The agricultural census of 1925 was incomplete and unreliable at many points, chiefly because of excessive stinting in expenditures. Official and trade estimates of annual production have been greatly improved in recent years, but many rest on quite insecure foundations. Our knowledge of meat production is faulty, especially on account of lack of information on important classes of Federally non-inspected slaughter; of fruits and vegetables, because commercial production is not segregated from noncommercial, and very little is known of the output of home gardens; of milk production, especially because of wide variations in annual outturn per cow and the lack of trustworthy sampling to secure a representative average. The growing multiplicity of food products increases the difficulty of obtaining comprehensive production data. The movement of produce by automobile truck affects the usefulness of data on car-lot shipments. On the other hand, the increasing scope of statistical endeavor, and the growing extent to which food moves through commercial channels, tend to show spurious indications of per capita increase.

Changing Content of the Diet.—Raymond Pearl, statistician of the Food Administration, computed the annual average food consumption of the United States, for the six years 1911–12 to 1916–17, at approximately 130 trillion calories. Expressing the population in terms of equivalent adult men (by a rough procedure open to certain criticisms), he calculated that this was equivalent to 4,290 calories per day per adult man, or, after allowances for edible wastage, to about 3,424 calories.[27] Pearl's elaborate calculations have not been continued beyond 1916–17. A revision of them in the light of fuller knowledge, and their extension forward and backward, would be of great interest; but the closer one gets to the data the larger the problems of estimate and assumption appear. On the basis of the foregoing discussion it would seem probable that corresponding figures for 1921–1928 would show an appreciable reduction in per capita intake, though not necessarily a reduction in intake plus edible wastage, for the latter may have increased.

Pearl's calculations showed the percentage distribution of calories contributed by various classes of foods as given in Table 6, for the period 1911–12 to 1916–17. Of outstanding importance, on this basis, appear wheat and corn among the cereals, pork (including lard) and beef among the meats, dairy products, and sugars. These foodstuffs alone con-

TABLE 6.—PERCENTAGE OF TOTAL FOOD VALUE FURNISHED BY VARIOUS FOODSTUFFS, AVERAGE 1911–12 TO 1916–17, ACCORDING TO RAYMOND PEARL[a]

(In terms of calories)

Commodity	Per cent	Commodity	Per cent
Wheat	25.90	Sugars	13.24
Corn	7.03	Potatoes	3.36
Rye	0.45	Legumes	0.83
Rice	0.60	Other vegetables	1.13
Other cereals	0.69		
		Total vegetables	5.32
Total cereals	34.67	Apples	1.08
Pork (and lard)	15.74	Bananas	0.40
Beef	5.30	Oranges	0.11
Mutton and lamb	0.61	Other fruits	0.62
Fish	0.41		
Dairy products	15.26	Total fruits	2.21
Poultry and eggs	2.02	Nuts	0.92
Oils	3.62	Cocoa	0.29
Oleomargarin	0.42		
		Total miscellaneous	1.21
Total meats, fish, poultry and dairy products, and oils	43.38		

[a] *The Nation's Food*, 1920, p 236 These figures make no allowance for edible wastage, which Pearl roughly estimated at 5 per cent for proteins, 25 per cent for fats, and 20 per cent for carbohydrates.

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[27] *The Nation's Food*, Philadelphia and London, 1920, pp. 247–248. See also Chap. V, Marketing.

tributed nearly five-sixths of the total calories consumed. It is pertinent to inquire what changes, if any, have taken place in the content of the diet in the periods since the one which Pearl treated.

Certain tendencies are fairly clear. Consumption of cereals, notably wheat and corn, has declined, while consumption of dairy products, vegetable oils, sugar, and miscellaneous vegetables and fruits, has increased. Official estimates for meats and lard point to a decline up to about 1917, and a subsequent recovery to a higher level about 1924, such that the average for 1921–1927 would be above the average for 1911–1917; but the basic data on meats and lard are so untrustworthy that the case is not entirely clear.

Cereals.—Cereals furnish a large proportion of the carbohydrate in the diet and are among the cheapest foods in terms of calorie yield. Wheat, the most important single food of a large part of the civilized world, contains some protein and fat and limited amounts of several mineral salts and vitamins A, B, and E. The wheat germ and other parts of the berry which are largely removed in milling are especially rich in the best wheaten proteins, oil, minerals, and vitamin B, and contain a good deal of vitamin E. Hence common white flour, which is commercially preferred because of its keeping qualities and is best liked by consumers, contains much reduced amounts of protein (and those of poor quality), of vitamin A, B, and C, and of calcium, sodium, chlorin, iron, and phosphorus. As compared with whole wheat flour, therefore, it requires more supplementation from other foods to insure a complete diet. Rice, the most important cereal in the diet of half the human race, is broadly similar to wheat; but polished rice, the ordinary commercial product, has lost even more of the valuable elements of the entire kernel. Corn also is similar in character to wheat, though it contains more oil and its proteins are of poorer quality.

The per capita use of cereals in the United States—notably corn meal and wheat flour—has tended downward for many years. Corn meal is to-day the mainstay of the diet only among a limited and decreasing fraction of the population, and bread has become less and less the staff of life. Holbrook Working has made careful calculations as to the per capita consumption of these cereals from 1889 forward for each year in which a census of manufactures was taken. According to his figures, summarized in Table 7, the daily average consumption of these two major cereal foods fell from 1,537 calories in 1889 to 901 in 1919, a reduction of over 40 per cent in 30 years. The decline was fairly continuous, though not at a uniform rate. The reduction in consumption of corn meal was most pronounced between 1899 and 1904, when flour consumption was declining slowly. Throughout the 30-year period ended in 1919, shifts from corn meal to flour as a basic staple of the diet, among classes previously accustomed to use corn meal extensively, tended partially to offset declines in flour consumption among other classes. The reduction in the two cereal foods combined was greatest in the five-year period 1914–1919, implying that under war conditions the secular trend was accelerated. From 1919 to 1923 the data indicate a slight recovery, rather than a continuance of the decline. This is probably to be interpreted as a temporary interruption of the downward trend, for the combined figure for 1925 was slightly lower than that of 1919. But it may well be that further declines, if and when the trend reappears, will be much more gradual than those which occurred between 1899 and 1909 or between 1914 and 1919. There are no present indications, however, that the cereals will regain the higher position which they formerly held in the American diet.

Several factors combine to account for the per capita decline in the use of cereals in the United States. Dietary studies of families in different income groups at a particular time almost invariably show that the higher the income, the lower the place of cereals (which are usually the cheapest foods) in the diet.[28] With a rising level of per capita incomes, the same tendency has been at work over a period of time. Moreover, the brunt of the decline in energy requirements has apparently been borne by the cereals, chiefly wheat flour and corn meal. They have suffered in competition with cheap sugar, another carbohydrate, and also with meats and other more expensive foods as the national diet has become increasingly diversified. This competition has been very real, though largely indirect and unnoticed. Even bread, as commercially baked in this country, now contains a smaller proportion of wheat

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[28] Cf. the following percentages (slightly recalculated) shown by a study of 391 families by R. C. Chapin, *The Standard of Living among Workingmen's Families in New York City*, New York, 1909, p. 140:

Income group	Percentage spent for					
	Cereals	Meats and fish	Eggs, milk, etc.	Sugar, etc.	Vegetables and fruits	Alcohol
$600– $699	21.0	29.2	21.5	7.9	13.8	6.6
700– 799	19.9	31.4	19.8	8.3	13.9	6.7
800– 899	19.0	31.6	20.2	8.5	13.2	7.4
900– 999	17.6	30.7	23.3	8.0	14.4	6.1
1,000–1,099	17.3	32.1	21.2	8.0	14.2	7.2

In many countries with very low per capita incomes, the tendency with increased prosperity is toward increasing per capita use of wheat and rice, and decreasing use of corn, barley, millets, and pulses. Up to a certain point, rising standards of living involve continuous substitution of the more esteemed cereals for the less esteemed, and perhaps absolute increase in cereal consumption. After a certain point is reached, however, further advance in standards of living leads to decline in cereal consumption, as in this country in recent years.

flour and a much larger proportion of milk, fats, sugar, and other ingredients than was true a generation ago. It is exceedingly difficult to say what has been the net effect of such influences as war-time propaganda for economy in flour, general discontinuance of the practice of serving free portions of bread with meals in public eating places, criticism of white flour as deficient in important nutrients and roughage, extensive advertising of bread as the "best and cheapest food," and changing proportions of waste.

TABLE 7.—AVERAGE PER CAPITA CONSUMPTION OF CORN MEAL AND WHEAT FLOUR, CENSUS YEARS 1889 TO 1925, ACCORDING TO HOLBROOK WORKING[a]

Year	Barrels of 196 pounds per annum		Equivalent in calories per day		
	Corn meal	Wheat flour	Corn meal	Wheat flour	Both products
1889	0 597	1 142	531	1,006	1,537
1899	.527	1 148	468	1,011	1,479
1904	390	1 133	346	995	1,341
1909	295	1 077	262	948	1,210
1914	210	1 036	187	912	1 099
1919	.129	.893	115	786	901
1921	.130	896	116	789	905
1923	139	.902	124	794	918
1925	.115	.902	102	794	896

[a] For corn meal, 1889–1923, from *Wheat Studies*, Food Research Institute, July, 1926, Vol II, p. 279, for wheat flour, revised figures for per capita consumption in barrels as given in his later study in *ibid.*, December, 1927, Vol IV, p 86 Other figures computed by Working's method.

Meat and Lard.—Meats furnish the major portion of the proteins of the diet, in a readily assimilable form; and meats and animal fats furnish a considerable but declining proportion of the fats. The fats largely serve as fuel, in a form easily converted into energy. As sources of fat, animal products are often more expensive than vegetable oils at present, except in countries where animal products are extensively produced for export and where vegetable fats are not produced in considerable amounts. The proteins serve primarily for building and rebuilding body tissues, but surpluses are converted into energy, with somewhat less economy than in the case of fats and carbohydrates. As sources of protein, meats hold a preferred position so far as the proteins are needed for rebuilding of tissue, but as sources of energy they are usually much more expensive than fats or carbohydrates.

The demand for meat is quite elastic: when meat prices are relatively low or times are prosperous, consumption tends to be high; when prices rise or purchasing power diminishes, consumption declines. In hard times much greater economy is practiced in utilizing meats and especially their fats. The yield of grease from garbage is said to afford a fair index of the state of employment. Changes in relative prices of different cuts

TABLE 8.—PER CAPITA CONSUMPTION OF MEATS AND LARD, 1900–1927, ACCORDING TO ESTIMATES OF THE BUREAU OF ANIMAL INDUSTRY[a]

Calendar year	Beef	Veal	Lamb and mutton	Pork excluding lard	All meats[b]	Lard	Meats and lard
	Pounds	*Pounds*	*Pounds*	*Pounds*	*Pounds*	*Pounds*	*Pounds*
1900	67.8	3.5	6.8	64.7	142.8	13.2	156.0
1901	69.0	3.9	6.9	63.0	142.8	12.9	157.7
1902	68.5	4.4	7.0	57.8	137.7	11.7	149.4
1903	76.0	4.7	7.2	59.3	147.2	11.8	159.0
1904	73.6	5.1	6.8	62.8	148.3	12.4	160.7
1905	73.0	5.4	6.5	58.8	143.7	10.0	153.7
1906	72.6	5.4	6.5	59.7	144.2	11.2	155.4
1907	77.5	6.7	6.4	64.4	155.1	13.5	168.6
1908	71.5	6.4	6.3	66.1	150.3	13.5	163.8
1909	75.4	6.9	6.6	60.1	149.2	11.5	160.7
1910	71.1	6.8	6.4	57.1	141.6	11.4	153.0
1911	67.7	6.4	7.8	64.5	146.5	11.3	157.8
1912	61.1	6.3	8.1	61.8	137.4	11.2	148.6
1913	60.6	5.1	7.5	63.0	136.3	11.4	147.7
1914	58.4	4.6	7.4	62.3	132.9	12.2	145.1
1915	54.5	4.3	6.3	59.5	124.8	12.9	137.7
1916	56.0	5.3	6.1	60.1	127.7	13.6	141.3
1917	59.5	6.5	4.6	49.3	120.1	11.7	131.8
1918	63.0	7.4	4.7	54.8	130.1	13.3	143.4
1919	61.6	7.7	5.8	54.8	130.0	12.3	142.3
1920	63.1	7.6	5.5	60.5	136.8	13.3	150.1
1921	56.9	7.0	5.9	63.5	133.3	11.3	144.6
1922	60.4	7.3	5.0	66.1	138.8	14.2	153.0
1923	61.3	7.7	5.2	74.7	148.9	15.3	164.2
1924	61.5	8.2	5.2	74.7	149.6	15.4	165.0
1925	62.1	8.7	5.2	67.6	143.6	13.2	156.8
1926	63.4	8.2	5.5	65.7	142.8	13.5	156.3
1927	58.0	7.4	5.4	68.5	139.3	13.8	153.1

[a] U S Department of Agriculture, Bureau of Animal Industry, *Meat Production, Consumption, and Foreign Trade in United States, Calendar Years 1900–1927*, p. 9.

[b] Including very small quantities of goat meat in certain years.

also afford some indication of the purchasing power of the mass of consumers. On the whole, meats constitute one of the most flexible elements in the diet; not only the total quantity purchased, but the proportions of the different meats, the choice of cuts, and the degree of utilization, vary from time to time as prices and purchasing power change.

Consumption of meats tends to vary also with conditions of production and transportation. It is distinctly heaviest in pioneer countries where cattle and sheep are extensively raised for export, as in Argentina, New Zealand, and Australia. As new countries pass out of the frontier stage in which grazing is a leading industry, the cattle and sheep industries decline in relative importance, their meats tend to become relatively expensive, and per capita consumption of beef and veal, mutton and lamb, tends to decline. This has been true in the United States. On the other hand, pork consumption is commonly light in new countries; and as agriculture becomes more intensive the proportion of pork in the diet tends to rise while other meats tend to decline.

In the United States the long-term changes in production conditions have tended, on the whole, to make for reduced per capita consumption of beef,[29] mutton, and lamb, and increased consumption of pork and lard, which we produce extensively for export. According to official estimates, which are by no means trustworthy,[30] this is what has actually occurred since the war as compared with a period before the war, as shown by Table 8. But there has apparently been a substantial recovery in beef and veal consumption from a low point in 1917, to a level not far below the prewar, and with a still greater increase in pork consumption, the total meat consumption per capita has ranged above rather than below prewar levels. So far as one may trust these figures, it would appear that increased purchasing power of classes who formerly ate little meat has more than offset tendencies to reduced consumption on the part of other classes. It does not follow, however, that there is increased ingestion. The wastes are heavier in pork, which now represents a larger fraction of the total, than in other meats; wastes tend to be higher in all meats when they are more freely purchased; and more of the less prized portion of the animal tends to go to inedible uses to-day than before the war. It is not improbable that ingestion of meats and animal fats has declined in recent years while "consumption" in terms of pounds has increased.

Poultry and Eggs.—Consumption of poultry, to judge by the imperfect index of receipts at great urban markets, increased substantially between 1920 and 1924, as shown in the following figures in millions of pounds:[31]

Year	New York	Chicago	Boston	Philadelphia	Four markets
1920	101 1	57 3	34.1	21.6	214 1
1921	124 6	65 0	39 9	22 9	252 4
1922	138 2	73 7	44 6	21 3	277 8
1923	163 9	90 3	56 0	24.6	334 8
1924	179 3	88 5	61.3	27.6	356 7
1925	170 3	72.1	46 7	29.3	318 4
1926	192.9	77 6	53.2	32.1	355 8
1927	188 1	63 7	53 3	31 8	337 0
1928	.....	...	....	....	349.0

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[29] A counteracting factor in the past fifteen or twenty years has been the tendency to market younger and lighter beef cattle.

[30] A recent criticism of the estimates is expressed in a forthcoming work by L. B. Zapoleon on *Inedible Fats in the United States* (Fats and Oils Studies of the Food Research Institute, No. 3).

[31] *Yearbook of Agriculture*, 1927, p. 1093.

The increase in the first half of the period 1920-1928 doubtless reflects first the recovery from war-time restriction and subsequently the passing of the depresssion, as well as growth of urban population. Since 1923 there has been no sustained advance, in spite of continued growth in urban population. Average prices received by producers of chickens show a more substantial advance from prewar years than has been secured for most farm products.[32] This fact lends support to an inference of increased per capita demand for and consumption of poultry, at least up to 1923.

Receipts of eggs at the four markets named above, and San Francisco, show a marked increase from a low point in 1920 to a high point in 1923 but rather lower levels since then.[33] If 1920 and 1923 are ignored, the upward trend appears to be slight, and no greater than the increase of population in the territory served. Prices of eggs to producers have risen rather less than prices of farm products in general, and much less than prices of poultry; and prices of fresh firsts in New York and Chicago have risen less than prices of foods in general.[34] This lends support to the view that demand for eggs has not kept pace with growth of population; but there may have been offsetting increases in smaller towns which can be supplied from farming regions near by. Certainly the farmers' wives have been under stress in recent years to make the most of the income they derive from their poultry. Exports of eggs in the shell have increased greatly since before the war, but imports of eggs not in the shell (mainly from China) have risen much more.[35]

Dairy Products—From a nutritive standpoint, milk is the most satisfactory single article of food consumed by man. Though not a complete food, it is the ideal food for compensating for deficiencies in other foodstuffs and is the one food for which there is no effective substitute. Along with 87 per cent water, it contains mainly proteins and fats of high quality, and milk sugar. It is unique in its calcium content, in good balance with phosphorus, but is poor in iron. Milk fats are the most important sources of vitamin A, and milk also contains vitamins B and C. Pasteurization largely eliminates vitamin C and may adversely influence the availability of its inorganic content, but does not otherwise affect its good qualities.[36]

The human consumption of dairy products in the United States has tended upward since the war, at least from 1920. Earlier data are unsatisfactory, and even the official estimates now available are by no means highly dependable, but all the evidence supports the stated inference. Production of milk has increased, not because of increased herds of dairy cows[37] but because, with improved breeds, selection, and feeding, yields per cow have risen. According to the official estimates as shown by Table 9, milk production increased from about 90 billion pounds in 1919 to over 120 billion pounds in 1926; thus production increased about one-third while the population increased about 11 per cent. The amount fed to calves has remained fairly constant, tending to constitute a declining fraction of 4 per cent or less, while waste, loss, and unspecified uses are estimated at around 3 per cent. The official estimates indicate an increase of nearly 50 per cent in the total consumption of fresh milk, and of nearly one-third in the per capita consumption of fresh milk,

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[32] *Ibid.*, p. 1097.

[33] *Ibid.*, pp. 1098–1099.

[34] *Ibid*, p. 1105.

[35] *Ibid.*, pp 1103–1104.

[36] Based on E. V. McCollum and Nina Simmonds, *The Newer Knowledge of Nutrition*, third edition, New York, 1927, pp. 152–156.

TABLE 9.—PRODUCTION OF MILK AND MILK PRODUCTS, 1919–1926, ACCORDING TO OFFICIAL DATA AND ESTIMATES[a]

(Millions of pounds)

Year	Estimated production	Manu-factured	Used for household purposes	Fed to calves	Waste, loss, etc
1919	90,058	45,352	38,619	3,500	2,587
1920	89,657	43,652	39,090	4,202	2,713
1921	98,862	46,493	45,143	4,260	2,966
1922	102,562	48,478	46,673	4,335	3,077
1923	109,736	51,830	50,440	4,174	3,292
1924	114,666	53,811	52,772	4,642	3,440
1925	116,505	54,637	54,326	4,047	3,495
1926	120,766	56,785	56,417	3,942	3,623

Year	Principal manufactured products				Whole milk used in other manu-factured products
	Butter	Cheese	Condensed and evap-orated milk	Ice cream[b]	
1919	1,560	420	1,925	230	[c]128
1920	1,539	362	1,578	260	198
1921	1,705	356	1,464	244	116
1922	1,778	375	1,431	264	177
1923	1,862	399	1,775	295	242
1924	1,956	418	1,700	286	277
1925	1,951	447	1,758	322	348
1926	2,067	427	1,734	325	311

[a] Data from *Yearbook of Agriculture*, 1927, p. 1067, and similar tables in earlier issues.

[b] Million gallons.

[c] Amount used in "chocolate" not given. In later years it is the largest item.

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[37] The statistics, such as they are, appear in the *Yearbook of Agriculture*, 1927, p. 1061. They suggest no material increase in the number of dairy cows between 1920 and 1928, and indeed a decline in 1925 and 1926.

between 1919 and 1926. There has been a general improvement in standards of quality, particularly as respects purity and cleanliness, and probably also in respect to fat content. Such an increase in milk consumption implies material improvement in the diet of children and of the poorer classes generally, and, especially in connection with improvements in quality, a higher degree of safeguarding of health besides.

The increase in consumption of milk products has apparently been less marked than the increase in consumption of fresh whole milk. According to the official estimates, the percentage of total output consumed as such for household purposes rose from 42.9 per cent in 1919 to 46.7 per cent in 1926; while the percentage manufactured declined from 50.4 per cent to around 47 per cent Nevertheless the quantity manufactured has risen rather steadily in per capita amounts as well as in total. Per capita figures for consumption of butter, ice cream, condensed and evaporated milk, and cheese, given in Table 10, show fairly continuous upward trends since 1919. The increase between 1919 and 1926 was about 23 per cent in the case of butter, 27 per cent in cheese, 32 per cent in condensed and evaporated milk, and over 45 per cent in ice cream.

TABLE 10—APPARENT PER CAPITA CONSUMPTION OF PRINCIPAL MANUFACTURED DAIRY PRODUCTS AND OLEOMARGARIN, 1919–1927[a]

Calendar year	Condensed and evaporated milk (pounds per annum)	Cheese (pounds per annum)	Ice cream (gallons per annum)	Butter (pounds per annum)	Total four products	Oleomargarin (pounds per annum)
1919	10.88	3.43	2.11	14.50	...	3.32
1920	10.10	3.53	2.32	14.60	...	3.38
1921	11.37	3.51	2.25	15.92	...	1.94
1922	12.46	3.72	2.39	16.37	...	1.64
1923	13.13	3.85	2.74	16.75	...	2.03
1924	13.82	4.12	2.67	17.42	...	2.03
1925	13.75	4.24	3.11	17.35	...	2.02
1926	14.34	4.37	3.07	17.87	...	2.08
1927	14.54	4.11	...	16.84	...	2.32
	Calories per day					
1919	24.2	18.3	25.8	143.2	211.5	32.1
1920	22.4	18.8	28.7	143.8	213.7	32.6
1921	25.3	18.8	28.4	157.2	229.7	18.7
1922	27.7	19.9	29.3	161.7	238.6	15.8
1923	29.2	20.6	33.6	165.4	248.8	19.6
1924	30.7	22.0	32.6	171.6	256.9	19.6
1925	30.6	22.7	38.1	171.4	262.8	19.7
1926	31.9	23.3	37.6	176.5	269.3	20.1
1927	32.4	22.0	...	166.3	...	22.4

[a] Based upon Working's calculations in *Wheat Studies*, Food Research Institute, July, 1926, VOL. II. p. 277, with certain revisions and additional figures.

In terms of calories per capita (which is by no means an effective measure in the case of milk), these four milk products showed an increase of over 27 per cent, from 212 to 270 calories per day.

The increased consumption of dairy products is the result of several factors. Higher purchasing power of consumers is undoubtedly one. Greater assurance of safety in the use of whole milk, as a result of public inspections and improved private practices, is another which has had cumulative effects. Wider appreciation of the special virtues of these foods, as a result of medical advice, the work of school and district nurses, the circulation of literature on child feeding, home economics teaching, and commercial advertising, has probably been a major factor. The closing of the saloons has had a double influence through setting free income formerly spent for liquor, and through promoting the spread of places where milk beverages and ice cream are served. The expansion of commercial production of ice cream has made this product more readily available. However it may be accounted for, the increased consumption of dairy products reflects improvement in food standards.

Vegetable Oils.—These products are ordinarily cheap sources of fat, but (like lard) lack vitamin A which is found in butter fat and liquid portions of beef fat. One of the most striking changes in the American diet of the past half century, and especially since the war, has been the

TABLE 11.—PROPORTION OF ANIMAL AND VEGETABLE FATS USED IN AMERICAN OLEOMARGARIN MANUFACTURE, 1912 TO 1927–28[a]

(Per cent of total fats)

Year	Of animal origin				Of vegetable origin			
	Oleo oil	Neutral lard	Other[b]	Total	Cottonseed oil	Coconut oil	Other	Total
1912	42.3	22.2	3.2	67.7	26.8	0.4	5.1	32.3
1914	48.7	20.4	4.3	73.4	22.2	0.1	4.3	26.6
1916	41.5	20.1	3.3	64.9	30.1	0.3	4.7	35.1
1917	38.5	16.9	4.2	59.6	25.3	7.9	7.2	40.4
1918	33.6	15.9	6.6	56.1	12.7	21.6	9.6	43.9
1919	31.8	14.9	5.6	52.3	12.3	22.7	12.7	47.7
1919–20	28.6	12.2	5.7	46.5	12.5	25.6	15.4	53.5
1920–21	21.0	12.4	4.9	38.3	7.8	43.6	10.3	61.7
1921–22	24.7	16.2	8.1	49.0	9.3	34.6	7.1	51.0
1922–23	25.7	16.2	6.2	48.1	10.3	36.2	5.4	51.9
1923–24	25.2	15.5	6.1	46.8	10.0	40.1	3.1	53.2
1924–25	23.5	13.7	6.6	43.8	11.2	42.3	2.7	56.2
1925–26	21.9	11.6	6.3	39.8	11.8	45.3	3.1	60.2
1926–27	21.8	11.1	5.7	38.6	10.5	48.2	2.7	61.4
1927–28	17.8	9.8	5.0	32.6	9.7	55.1	2.6	67.4

[a] Data for 1912–1924 from United States Tariff Commission, *Certain Vegetable Oils*, Part 2, pp. 168–169; for 1925–26 and later years from Annual Reports of the Commissioner of Internal Revenue.

[b] Butterfat content of milk consumed calculated on basis of 3.8 per cent butterfat in milk.

increasing use of vegetable oils, either in place of animal fats or as supplements to them. The change can be observed even in the composition of oleomargarin, a product containing both animal and vegetable fats, as shown by Table 11. Prior to the war, vegetable oils usually furnished less than one-third of the total fatty ingredients; with the increasing use of coconut oil, which is solid at ordinary temperatures, the proportion of vegetable oils has risen until recently they have constituted over 60 per cent.

The consumption of margarin has never been so high in the United States as in several countries of Europe, where, as shown by Table 12, it has been highest in a few small countries which are large producers of dairy products. Since the war, in spite of the recovery in production of animal fats and dairy products, the consumption of margarin has tended upward, largely because of technical improvements making for higher palatability, perhaps also because of truer knowledge of its food value.

TABLE 12.—ESTIMATED PER CAPITA CONSUMPTION, IN POUNDS, OF OLEOMARGARIN IN VARIOUS COUNTRIES, 1913, 1924, 1926[a]

Country	1913	1924	1926
Denmark	33.0	45.6	49.5
Norway	24.0	35.3	38.5
Netherlands	4.4	15.7	18.7
Germany	7.9	12.3	14.3
Sweden	9.9	12.3	13.2
United Kingdom	7.8	11.8	13.2
Belgium	3.3	7.4	10.0
France	0.9	1.5	2.2
United States	1.5	2.1	2.1

[a] *Foreign Crops and Markets*, May 14, 1928, Vol. XVI, p. 704, citing various sources.

In the United States, legislation has been restrictive, and there is some popular prejudice against margarin. The consumption rose to unusually high levels during the war and immediately after, when butter prices were relatively high. From a peak in 1920, as shown by Table 10, per capita consumption of margarin sharply declined to a level in 1922 less than half the 1920 figure, while butter consumption increased by about the same amount. The increase in per capita consumption of butter represented in part a recovery from a temporary decrease in consumption during 1917, 1918, and 1919. Since 1922 butter and margarin consumption have both tended upward, though preliminary figures for 1927 show a decline in butter greater than the increase in oleomargarin. Taking the two products together, the net increase in terms of calories per capita was only about 12 per cent between 1919 and 1926.

Another important factor in the displacement of animal fat by vegetable oil is the increased use of vegetable oils as shortenings and cooking fats. This began in the eighteen eighties with the adulteration of lard with cottonseed oil. Later lard substitutes were manufactured from oleostearin and cottonseed oil. About 1910, with the development of the process of hydrogenating oils, solid cooking-fats were produced from cottonseed and similar oils alone. These now represent one of the most important types of fats for cooking and shortening purposes. The volume consumed is of the same order of magnitude as the quantity of lard exported; indeed, if it were not for this extensive use of vegetable oils, but a small lard export would be possible in some years. Consequently, cottonseed oil has been extensively diverted from industrial to dietary uses.

Finally, with the increase in consumption of fresh fruits and vegetables in the form of salads throughout the year, goes an increased use of salad oil. This is in part olive oil, but also, in large part, carefully refined, deodorized and decolorized cottonseed oil. Salad oil may be consumed as such, but a large part of the consumption is in the form of prepared mayonnaise and other dressings, and their manufacture has become a considerable industry.

Altogether, the increased use of vegetable oils has contributed to diversification of the diet, to convenience in the kitchen, and to some actual and more potential cheapening of the food fats as a whole. It has come about largely as a result of improved technology, supplemented by vast commercial advertising. Provided the nutritive deficiencies of vegetable oils are made up by other components in the diet, as is ordinarily the case, there are no offsetting dietary disadvantages.

Sugar.—Consumption of sugar in the United States has tended upward for many years, and has risen to a notable degree in the years since the war. Cane sugar and beet sugar, the principal classes, are almost pure carbohydrate, in a form readily shipped, sold, stored, used, and assimilated. Sugar is prized not merely for its food value, but for the appetizing taste that it lends to many foods and beverages. In ordinary years it is a cheap food. It is economical also in the sense that little is wasted. Statistics of sugar production are fairly reliable. Statistics of stocks are poor, and stocks may vary so greatly that production data for a single year afford no satisfactory index of consumption. In averages over a period of years, however, variations in stocks may be disregarded.

As shown by Table 13, apparent per capita consumption of beet sugar and cane sugar (disregarding stocks) rose sharply in the last century from the late eighties to the middle nineties, again in the early years of the new century, and then climbed slowly to a record level of nearly 90 pounds (in terms of raw sugar) in the two or three years before the war. With higher prices, it declined during the war years to around 80 pounds in 1915–16 to 1917–18. The subsequent movement has been strikingly upward. Per capita averages for two successive fiscal years have risen as follows:

79 pounds in 1909–1911, 88 pounds in 1912–1914, 80 pounds in 1916–1918, 100 pounds in 1920–1922, and 113 pounds in 1925–1927. But by no means the whole of this increase has occurred in clearly visible forms. More and more sugar is consumed in bread, cake, ice cream, confectionery, and other commercial foodstuffs.

TABLE 13 —APPARENT PER CAPITA CONSUMPTION OF CANE AND BEET SUGAR IN THE UNITED STATES, IN TERMS OF RAW SUGAR, 1888–89 TO 1927–28[a]

Year, July–June	Pounds per annum	Calories per day	Year, July–June	Pounds per annum	Calories per day
1888–89	50 96	242	1908–09	82 18	390
1889–90	51 37	244	1909–10	79 72	378
1890–91	61 01	289	1910–11	78.14	370
1891–92	60 81	287	1911–12	83 85	396
1892–93	64 88	307	1912–13	86.34	409
1893–94	73 73	350	1913–14	90 41	428
1894–95	63.32	300	1914 15	86 95	412
1895–96	64 65	305	1915–16	78 66	372
1896–97	79 00	375	1916–17	82 25	390
1897–98	48.07	228	1917–18	77 75	368
1898–99	62 60	297	1918–19	83 64	396
1899–1900	59 69	283	1919–20	91 14	431
1900–01	72.86	345	1920–21	97 62	463
1901–02	64 32	305	1921–22	102 43	486
1902–03	80.10	380	1922–23	106 61	505
1903–04	70 15	332	1923–24	100 21	474
1904–05	73 35	348	1924–25	114 43	542
1905–06	77 20	366	1925–26	114.67	543
1906–07	82.77	392	1926–27	111.17	527
1907–08	75 54	357	1927–28	110.16	522

[a] Figures for 1888–89 to 1907–08, in pounds per capita, as calculated by Working, in *Wheat Studies*, July, 1926, Vol II, p. 278. Lates figures computed by Working's method from data in *Yearbook of Agriculture*, 1927, p 959, which differ from the earlier by allowing for domestic exports in forms other than sugar

Higher levels of incomes account in part for increases in per capita consumption of sugar.[38] Another factor in the postwar increase has been the relatively low prices of sugar since 1920, in consequence of the revival of beet sugar production in Europe, following a great expansion in cane sugar production in Cuba, Java, Hawaii, and elsewhere during the war. These conditions have made it possible for consumers to indulge their tastes for sugar at relatively small cost. Prohibition may have been a contributing factor, as in the case of milk. The increasing use of fruits also has tended to a concomitant increase in the use of sugars.

At present levels of consumption, cane and beet sugar appear to furnish over 500 calories per capita per day to the diet, as compared with about 400 in the last prewar years. Such an increase in sugar intake is the more striking in the face of declining physiological needs for food, especially of energy-yielding foods, and it is undoubtedly related to the decline in consumption of cereals. The result has been an increase in the palatability of the diet, with increased economy of effort, less waste of foodstuffs, and no demonstrably deleterious effects upon health.

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[38] There are strong indications that sugar consumption tends to increase materially in times of prosperity and to decline or increase but slightly in times of depression.

Fruits and Vegetables.—Most vegetables and fruits, including nuts, contain more or less carbohydrate, and some, such as white and sweet potatoes, bananas, and chestnuts, are especially rich in it. Most of the common food nuts, except chestnuts, are rich in fat. These and the pulses (such as peas, dried beans, and soy beans) are rich in proteins, but with certain exceptions these proteins are of inferior quality. Other vegetables and nuts contain more or less protein. In respect to their contribution to the diet, there are great differences among the several fruits and vegetables, and even among varieties, individual specimens, and parts of the whole. As a class, their nutritive importance lies less in the factors mentioned above than in others more recently analyzed. Most fruits and vegetables are important sources of vitamins A, B, and C. Certain vegetables, especially the leafy ones, are important for their content of mineral salts and their contribution of bulk roughage. Fruits are valuable for their mild laxative qualities and their tendency to maintain the normal alkali reserve in the blood which tends to be disturbed by an undue proportion of cereals, most other food seeds, and meats. Hence these products are valuable supplementary foods despite their respective deficiencies.

The acreage of 19 commercial truck crops, including early potatoes, leading fresh vegetables, and cantaloupes, watermelons, and strawberries, has increased since 1919 as shown in the following statement, in thousands of acres:[39]

1919	1,586	1924	2,373
1920	1,697	1925	2,548
1921	1,436	1926	2,461
1922	1,943	1927	2,435
1923	2,014	1928	2,711

These figures show a distinct upward trend.

From year to year variations in weather conditions cause a considerable variation in crops of fruits and vegetables; as it happens, 1921 was a poor year for most of these crops. Exports and imports are relatively small; even exports of apples average only about 11 per cent of the commercial crop. Except for imports of tropical products such as bananas, pineapples, coconuts, and a few others, the tendency has been, under substantial tariff duties and with expansion of domestic production and foreign demand, toward lower imports and larger exports of fruits and vegetables as a group. In recent years domestic exports of fruits and nuts, in the aggregate, have exceeded imports.[40] At certain seasons of the year, tomatoes, onions, and other vegetables are imported. In the main, however, shipments and consumption tend to vary with the domestic crop. The trends of crops and shipments, therefore, are the most readily available indicators of consumption.[41] Tables 14 and 15 summarize some of the significant available data for domestic products, and Table 16 shows the growth in imports of bananas.

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[39] *Yearbook of Agriculture,* 1925, p. 941, and 1927, p. 903, and *Crops and Markets,* December, 1928, p. 461; according to the Division of Crop and Livestock Estimates. Data for carrots are lacking until 1923, when the figure was 9.77 thousand acres.

From these indicators certain reasonable inferences can be drawn regarding per capita consumption since the war. That of certain staple fruits and vegetables—apples, white and sweet potatoes, cabbage, and onions—has risen comparatively little or not at all. That of most other fruits and a number of vegetables has risen substantially. That of celery, spinach, lettuce, carrots, and snap beans has risen a great deal. The increase has been greater in fresh products than in dried or canned products. Comparisons with prewar years are rendered difficult by lack of comparable data, but there is reason to believe that the trends mentioned have been accentuated during the present decade. One of the most striking increases is shown by lettuce, of which car-lot shipments increased steadily from 13,788 in 1920 to 51,446 in 1928, to a rank (among the vegetables) in the latter year second only to white potatoes. Shipments of spinach showed an equally great relative increase, from 2,891 carloads in 1920 to 10,573 in 1927, while the relative increase was still greater in carrots and snap beans.

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[40] This is shown, for fruits and nuts, by the following official data, in thousands of dollars:

Annual average	Domestic exports	Imports	Excess of imports (*) or exports (†)	Year	Domestic exports	Imports	Excess of imports (*) or exports (†)
1886–1890	3,724	19,584	*15,860	1920	84,390	101,551	*17,151
1891–1895	4,075	21,322	*17,247	1921	70,157	73,532	*3,375
1896–1900	8,394	17,661	*9,267	1922	75,864	72,499	†3,365
1901–1905	14,778	23,034	*8,256	1923	68,619	70,463	*1,844
1906–1910	16,531	33,692	*17,161	1924	97,689	72,336	†25,354
1911–1915	31,865	43,033	*11,168	1925	102,015	88,664	†13,351
1915–1920	61,501	61,755	*254	1926	111,797	87,337	†24,460
1921–1925	82,869	75,499	†7,370	1927	121,665	84,721	†36,944
1926–1928	120,930	87,184	†33,746	1928	129,329	89,494	†39,835

Data for 1886–1925 from *Statistical Abstract of the United States*, 1925, pp. 462, 464; later data from *Monthly Summary of Foreign Commerce*, December, 1927 and 1928.

[41] Unloads of 13 commodities at 11 principal markets tell much the same story, but are less complete for the earlier years. Cf. *Yearbook of Agriculture*, 1927, pp. 904–905.

Car-lot shipments do not, of course, reflect the situation accurately. On the one hand, increasing specialization in production and increasing concentration of population in cities have made for shipments in larger lots; on the other, there has been a considerable growth of shipments by automobile truck, especially of fresh vegetables, and of sale in roadside markets, especially of fruits. The chances are that, by and large, the shipment figures understate rather than overstate the actual growth of the trade. All the evidence supports the conclusion that, particularly in the cities and towns but even in rural areas, there has been a notable increase in the consumption of a great variety of fruits and vegetables, especially in the fresh state.

The great stress that has been laid on the several virtues of fruits and vegetables, especially those heretofore less commonly used, has undoubtedly exerted great influence on this growth. To this, education, the nutrition experts, the medical and nursing professions, home economics teachings, food faddists, restaurants, and commercial advertisers,

TABLE 14.—CAR-LOT SHIPMENTS OF LEADING FRESH FRUITS IN SEASON FOLLOWING HARVEST, 1920–1928[a]

Harvest year	Apples, June–June	Peaches, May–Nov.	Pears, June–May	Watermelons, Apr.–Jan	Cantaloupes, Apr.–Dec.	Strawberries, Jan.–Dec.
1920	116,117	28,179	15,941	37,314	22,953	7,199
1921	89,560	27,334	13,053	45,749	25,815	10,865
1922	113,959	38,405	20,381	47,625	29,930	18,761
1923	138,184	33,525	18,589	33,029	25,923	17,801
1924	103,844	39,395	16 246	45,745	31,496	18,966
1925	127,909	40,845	21,257	44,184	33,819	12,256
1926	133,848	58,465	25,209	55,126	33,424	13,528
1927	93,094[b]	41,714	18,744[b]	45,460	36,757	17,893
1928[b]	.	56,596	... ..	48,347	38,600	18,788

Harvest year	Oranges, Sept.–Aug[c]	Grapefruit, Sept –Aug.	Lemons, Nov.–Oct.	Mixed citrus, Sept.–Aug[c]	All citrus fruits	Grapes, June–Dec.
1920	67,839	11,614	11,836	. .	.. . .	41,310
1921	44,317	13,516	9,907	. .	.. ..	37,817
1922	71,908	17,627	8,947	3,685	102,167	59,918
1923	79,036	20,337	13,391	5,070	117,834	65,336
1924	59,582	21,216	11,683	5,402	97,883	69,993
1925	67,091	15,331	13,982	5,171	101,575	81,878
1926	76,313	18,858	13,496	6,984	115,651	78,590
1927	60,634[b]	16,160[b]	12,680[b]	7,941[b]	97,415[b]	82,572
1928[b]	... .	.... .	......	... .	.. . .	79,825

[a] Data from *Yearbook of Agriculture*, 1927, and earlier issues, as "compiled from daily and monthly reports received by the bureau (of Agricultural Economics) from officials and local agents of common carriers throughout the country Shipments . . . include those by boat reduced to car-lot basis" Preliminary data furnished by United States Department of Agriculture in advance of publication.

[b] Preliminary estimate.

[c] For California, November–October.

TABLE 15.—CAR-LOT SHIPMENTS OF PRINCIPAL VEGETABLE CROPS, SEASONS FOLLOWING HARVESTS OF 1920–1928[a]

Harvest year	Potatoes, Jan–Dec	Sweet potatoes, July–June	Cabbage, Dec–Apr. (17 mos.)	Onions, Mar–June (16 mos)	Tomatoes, Jan–Dec	Celery, Dec–June (19 mos)	Dry beans, Jan–Dec
1920	185,176	17,206	34,826	29,473	18,394	10,859	8,981
1921	218,001	19,383	31,432	20,890	17,415	11,706	12,955
1922	245,407	21,566	41,347	30,478	26,717	14,920	11,761
1923	241,554	14,530	36,990	28,762	23,964	17,160	12,990
1924	252,095	16,067	41,951	30,796	26,830	18,429	15,903
1925	241,523	20,859	39,052	31,646	28,254	21,913	17,540
1926	232,422	25,738[b]	40,515	33,063	26,071	21,000	17,683
1927	253,445	..	39,067[b]	35,191[b]	32,664	24,471[b]	17,154
1928[b]	254,553			.	30,336	. .	14,435

Harvest year	Lettuce, Jan–Dec	Spinach, Oct–Dec (15 mos)	Cucumbers, Jan.–Dec	Snap beans, Jan–Dec	Cauliflower, July–June	Carrots, Jan–June (18 mos)	Asparagus, Mar–July
1920	13,788	2,891	3,689	1,473	3,853	1,602	1,226
1921	18,738	4,747	4,832	1,600	4,363	1,839	902
1922	22,240	4,914	6,349	2,631	4,608	2,256	767
1923	29,485	7,580	5,700	3,328	4,303	1,956	785
1924	30,935	7,507	7,182	4,618	4,454	3,299	1,235
1925	37,306	7,919	8,492	5,224	6,728	3,443	1,906
1926	42,105	9,383	7,272	4,854	6,892	4,303	2,419
1927	46,850	9,655	8,180	7,301	9,046[b]	6,852	2,132
1928[b]	51,446	10,573	7,468	5,760		6,911	2,878

[a] Sources as for Table 14. Figures refer only to 12 months from any state of shipment, but shipping seasons in different states overlap in certain cases

[b] Preliminary estimate.

TABLE 16.—IMPORTS OF BANANAS FOR CONSUMPTION, 1900–1927[a]

Year July–June	Thousands of bunches	Thousands of dollars	Year July–June	Thousands of bunches	Thousands of dollars	Calendar year	Thousands of bunches	Thousands of dollars
1900–01	.	6,552	1909–10	39,142	11,633	1919	36,993	15,935
1901–02	25,342	7,305	1910–11	44,734	14,375	1920	39,320	19,088
1902–03	29,711	8,535	1911–12	44,510	14,368	1921	43,366	19,385
1903–04	25,751	7,748	1912–13	42,262	14,484	1922	45,094	19,146
1904–05	38,094	9,883	1913–14	48,691	16,398	1923	43,956	19,739
1905–06	35,103	10,330	1914–15	41,085	13,513	1924	47,384	22,074
1906–07	37,437	11,883	1915–16	36,755	12,106	1925	55,483	29,693
1907–08	37,073	11,391	1916–17	34,642	12,719	1926	56,251	31,684
1908–09	36,905	11,012	1917–18	32,138	15,438	1927	61,009	34,269

[a] Compiled from *Foreign Commerce and Navigation of the United States*, for 1900–1926, and *Monthly Summary of Foreign Commerce*, for 1927 and 1928.

have all contributed. Higher purchasing power of the mass of the people, together with relatively low prices for such staples as cereals, lard, and sugar, have given latitude for enlarging the scope of the diet. Prohibition has directly increased the demand for grapes and at times other fruits; indirectly it has promoted the increased use of fruits served as or with light refreshments. There has been a growing appreciation of the palatability, variety, attractiveness to the eye, and digestive pleasures afforded by fresh fruits and vegetables, especially with the need for a lighter diet than was formerly customary. There has been increasing satisfaction in the convenience afforded by the canned products.

There also has been increased specialization in production and improved transportation and marketing. Grading and inspection at points of shipment and receipt, better packing, careful control of temperature in transit, fast freight trains, delivery on schedule, allocation to markets in accordance with knowledge of local demand and supply—these have made it possible to ship over greater distances with less loss in transit and less risk in sale. Under these circumstances, producing areas have been developed from border to border and from coast to coast; and the consumption season for all fresh products has been notably lengthened, until for so tender a product as lettuce the season is the whole year. Along with this has gone a reduction in prices, not so much in the height of the local season as in the rest of it, for in the process the local producers have suffered in competition with distant growers.

The expansion in consumption of fresh fruits and vegetables, especially of the types formerly used less extensively, has made a significant contribution to the American diet, nutritionally and in auxiliary satisfactions. The increase in consumption of the dried and canned products, which are valued especially for their convenience, has also been considerable, though less marked because of the greater availability of the fresh products. The net effect has been to raise food standards in each important respect.

Diversification and Quality of the Diet.—By contrast with American diets of earlier periods and the diets of most other countries to-day, the present dietary in the United States is remarkably diversified. Staples play a smaller part, and even they are available in more varied forms. A larger variety of foods is used, and increasing quantities of former rarities. Especially notable has been the increased use of a great range of fresh fruits and vegetables. The consumption of salads, which introduce a large element of variety, has undergone a marked expansion. Foods formerly limited to the well-to-do have come more and more within the reach of the masses.

From a nutritional standpoint diversification of the diet represents a gain, primarily because, without sacrificing the provision for intake of proteins, it tends to insure and stabilize the intake of vitamins, mineral salts, alkaline elements, and roughage. There is no longer serious danger of shortage in these essentials of the diet, in any class of the population, except as ignorance or carelessness may be the cause; and such choices of foods are available that the diet selected without thought on these matters is more likely, nowadays, to be adequate in these respects. Furthermore, the adaptation of the diet to different nutritional needs of different members of a family, at different seasons, and under different circumstances, has been rendered easier.

The direct tendency of the diversification of the diet is probably toward complicating the provision, serving, and care of food. More things are ordered or purchased from more places. More articles of different kinds are kept in pantry and storage shelves. More operations, utensils, and dishes are involved than with simpler diets. More leftovers are to be disposed of. An increase in household labor from these causes has partially offset the saving through heavier purchase of foods in smaller units and ready-to-serve or partially prepared, far better culinary equipment, and smaller, better planned kitchens.

The quality of commercial foods has tended to improve in consequence of public regulation and industrial developments. Almost every year witnesses an increase in the public control over the production and sale of foodstuffs, through regulations extending all the way from grower to final consumer. Inspection of dairies, public efforts to eradicate bovine tuberculosis and to eliminate typhoid germs, tests of milk for bacteria count and butter fat content, and enforced pasteurization, have raised the effective standards for fresh milk, especially as concerns its safety for human consumption and probably to some degree making for higher food value. Meat inspection, particularly by the Federal service and city inspectors, has limited the sale of products made in part from the materials that are disease-producing, decomposed, revolting, unclean, or otherwise unfit for food; though such control is by no means universally effective, and there are indications that uninspected local slaughter has increased. Measures to prevent the sale of fruits and vegetables containing poisonous residues from spraying or other treatment, and to insure the wholesomeness of canned foods, are increasingly applied by commercial enterprises on their own account or under public control. The level of sanitary conditions under which other foods, including bakery products, are processed and sold has risen, partly as a result of public inspection, partly in consequence of the larger scale of enterprise, and partly because of the desire to appeal to the consumer's desire for assurance on this score. To a considerable extent, indeed, such regulations and practices rest upon aesthetic rather than physiological foundations; but the net effect has been to improve, to a notable extent, the quality and reliability of foods of all kinds. The present diet, at least in urban centers of this country, may reasonably be accounted the best in the history of the country—physiologically, psychologically, and with respect to economy of the consumer's effort.

The Food Cost of Living.—In spite of reduced physiological requirements per capita, low producers' prices of many foodstuffs, and economies incident to larger-scale production, the cost of the present diet is relatively high. For this a number of factors are responsible.[42]

The changing content of the diet, as well as its mere diversification, has involved a substantial amount of replacement of low-priced staples, rich in calories, by relatively high-priced articles, poor in calories. Pound for pound, fruits and vegetables are somewhat more expensive than cereals; but calorie for calorie, they cost several times as much as cereals. On a calorie basis, poultry is usually dearer than butcher's meat, butter than lard or margarin. Increased consumption of dairy products, physiologically important though it is, has added materially to food costs, except in so far as milk has been substituted for meat. Sugar is the outstanding exception to this general tendency. Added expense is involved in effective recognition of the special nutritive virtues of milk, cheese, butter, eggs, fruits, and vegetables, as compared with cereals (as commonly used), sugar, dried beans, and cured fat meats.

The large and increased spread between producer's prices and retail prices, which has attracted wide comment, affects producer and consumer in varying degrees from year to year. This widening margin is caused not merely by avoidable wastes in distribution, which are heavy indeed, but by a number of other factors. Each year sees a decline in the contribution of home gardens and fruit trees to the family table, as the proportion of urban and apartment house dwellers increases, and as land becomes more expensive in towns and rural areas adjacent to cities. Increasing concentration of population in cities inevitably makes for heavier terminal costs, and necessitates drawing supplies from more distant sources. The increasing geographical specialization in production necessitates longer hauls and costly care in preservation of perishables. Public regulation and private practices that have brought about improvement in quality of foodstuffs have also entailed substantial increments of cost. It is probable that expensive competitive advertising, which has been resorted to both in order to break down inertia of consumers and to expand the market for less staple products of many kinds, and in order to check the decline in consumption of staples, such as bread and meat, is partly reflected in higher food costs. In the main, the increased intermediate costs have been especially pronounced in those articles in the diet of which the consumption has increased the most.[43]

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[42] In addition to the factors discussed in the text, two others deserve passing notice. The tariff unquestionably has an influence in the case of a number of commodities, but to what extent it is exceedingly difficult to ascertain. Immigration restriction and other factors making for higher labor costs per unit of product also have some influence.

[43] These matters are discussed in various publications of The Port of New York Authority. Cf. especially *Some Facts about Margins and Costs in Marketing Fruits and*

Changes in household practice have made for higher food costs, in large part to economize effort in the household; how far this involves increases in final cost can not be calculated, since no accounting for the cost of the housewife's labor is possible. The modern construction of dwellings, especially with the trend toward multifamily houses, provides little storage space and favors the simplification of cuisine. The trend of household management is in the direction of smaller operations. More and more, foods are bought ready cooked or prepared for a particular meal, and leftovers are relegated to the garbage pail. Less and less is food prepared for use over several days or longer periods. The tendency is toward smaller and more numerous purchases; hence the abandonment of the two-pound loaf for the one-pound, the demand for smaller units of prepared or canned foods, and increased preference for cuts of younger, smaller, leaner animals.

Furthermore, it would appear that each year a larger proportion of the national food supply is consumed outside the home, in public eating places. This is in part the reflection of increased short-time mobility of the population, and increased distance between residence and place of work. To an increasing extent the family obtains on a commercial basis the services that would otherwise be contributed by the housewife on a noncommercial basis.

On the whole, the common American diet of to-day is expensive—probably as compared with simpler diets of earlier years, certainly as compared with a simpler adequate diet to-day. In terms of gold it is probably higher than in any other country. Even after allowance for changes in the purchasing power of the dollar, it is almost certainly higher than before the war, and has probably tended upward since 1921.[44]

Vegetables in the Port of New York District, New York, 1925. Nevertheless, one observes that the Bureau of Labor Statistics index of food prices at retail has risen in the country at large as much as in New York City, and more than in San Francisco, though rather less than in Chicago and Detroit.

[44] These statements are not inconsistent with the showing of index numbers of the food cost of living, which seem to show that food costs have risen, since before the war, less than consumers' goods in general, and less, on the whole, than the general level of prices. These indexes are based on the cost of an unchanging combination of more or less staple foodstuffs. They do not reflect the cost of the food actually purchased. Even the foods covered by such indexes are purchased in changing quantities as prices and purchasing power change. This is true of meats especially, but of many other foods in less degree. Similarly, indexes of the cost of living contain several groups, each composed of a fixed combination, and the weights of the units and groups are held constant over considerable periods of years. The comments here made would apply in like manner to other factors in the standard of living. Adaptations of purchases to changes in relative prices limit the extent to which increases or decreases in the index are reflected in actual outlays. On the other hand, the expansion of expenditures with increased purchasing power, aided by low prices of certain staples such as bread, lard, and sugar, has come to a large extent in foods not represented in the indexes.

The diet of to-day is, however, more flexible with changes in prices of different foodstuffs and in the purchasing power of the consumer. Increase in price of most single food products now makes a smaller proportional difference in the aggregate cost. Shifts from one foodstuff to another more or less similar are easily made, partly because others are freely available, partly because shifts are customary and are therefore accepted rather than resented. Economy in expenditures can probably be effected with less irksomeness.

Large outlays for food do not necessarily imply that food expenditures absorb a large percentage of income, any more than high wage scales necessarily imply high labor costs. Indeed, the almost universal testimony from studies of expenditures of families in various income groups, in a given class and locality, is that the higher the income the lower is the proportion spent for food. The validity of this, the first of Engel's famous laws, is attested by numerous studies, regardless of the country or group investigated. The indications are that, as a whole, the American public spends for food a smaller percentage of its income than is the case in any other country. There seems to be no reason to doubt that, with increases in real wages, this percentage has been materially smaller in recent years than before the war. Whether it is now tending upward, or downward, it is impossible to judge. Variations from year to year, and from times of depression to times of prosperity, are sufficient to obscure the trend on the present high level. But we lack adequate and trustworthy data on family expenditures, especially for comparisons over a period of time.[45]

III. MANUFACTURED GOODS[46]

To estimate the changes in the total consumption of manufactured goods from time to time is a statistical impossibility. The shift from domestic to factory production, which in the long run has unquestionably been great, cannot be measured. Separation of the total output of many commodities that are used partly in consumption and partly in the production of other goods is for many reasons often not feasible. Where the value of output of specific goods is known, the problem of discovering a suitable price index to convert value into physical units has not yet been solved. This is strikingly the case with many textile products, where both production and consumption would appear to run counter to the prevailing trend. Probably the only, and certainly the most useful, approach to the problem consists in judging the movements in consumption by inferences drawn from the statistics of manufacturing output.[47]

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[45] The Bureau of Home Economics in the Department of Agriculture has recently secured a small appropriation for beginning a national survey of dietary habits. It is greatly to be desired that properly planned studies of family expenditures be carried on during the next few years in connection with investigations on distribution already under way.

[46] The material for this section was prepared by Woodlief Thomas, formerly of the Division of Research and Statistics of the Federal Reserve Board, and the census data were taken in the main from E. E. Day and W. Thomas, *The Growth of Manufactures*, Census Monograph, No. IX.

On the basis of this material, the recent trends in the consumption of manufactured goods seem to be reasonably clear. There is, first, the enormous increase in the use of the automobile and the products associated with it. Almost equally striking has been the growth in the consumption of a great variety of mechanical devices for household use. In general, the period has been characterized by the widespread substitution of machine for hand-made products bought by the ultimate consumer.[48] Simultaneously with the advance in the use of the automobile there has been a marked development in the purchase of many commodities that a decade ago would have been described as luxury goods, but which have since entered so universally into the average budget as no longer to be regarded as such.

Since little is known of the extent of the shifts in consumption that take place in the average home, no estimate can be ventured of the lesser or greater income required for the purchase of these new goods. While there may have been some relative reduction in the cost of food and clothing, the gains from this source are probably dissipated by the higher relative prices of other commodities. There is certainly no overwhelming evidence that the new goods are together cheaper than the items they have replaced. Likewise, little that is definitive can be done with dating the beginning of these discernable trends in consumption. While some clearly began in the prewar period, they assumed imposing magnitude, either during the war or since 1919. In the body of this discussion, comparisons for the purposes of dating are made usually between the course of events during the long period from 1899 to 1925 and the short period from 1919 to 1925.

An attempt to indicate in the large the total movements in the use of goods that are consumed and of those that enter further into the processes of production is contained in Table 17. As it has already been pointed out, the measurement of output in physical units is for many of the products of manufacturing industry impossible. Use was, therefore, made of the number of wage earners and of the amount of primary horse power installed, as barometers of the growth of specific industries. Both measures are for this purpose defective: the number of wage earners, because increased efficiency has resulted in increased output with a

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[47] See Chap. VI, Labor, p. 449.

[48] See Mechanization, Chap. II, Industry, Part 1, p. 84, Part 2, p. 104; Chap. III, Construction, p. 234; Chap IV, Transportation, Part 1. p 262; Part 2, p. 312; Chap. V, Marketing, pp. 324, 328, 350; Chap VI, Labor, p. 483; Chap. VII, Management, p. 511; Chap. VIII, Agriculture, p. 557.

TABLE 17.—GROWTH OF SELECTED INDUSTRIES, PER CENT OF INCREASE OR DECREASE

(Decrease indicated by minus (–) sign)

Industry	1899–1925			1919–1925		
	Quantity of output	Wage earners	Horse power	Quantity of output	Wage earners	Horse power
All industries	175	80	256	29	– 7	22
I Producers' goods:						
A. Basic material and supplies—						
Iron and steel	204	102	307	32	– 3	14
Nonferrous metals	322	89	462	32	– 9	22
Petroleum refining	1,140	435	990	108	11	65
Chemicals and acids	472	231	652	36	–24	43
Gas, manufactured	406	110	1,246	14	10	80
Coke	189	36	1,077	16	–21	82
Paints and varnishes	210	163	372	40	19	69
Cement	931	230	944	101	51	78
Glass	272	31	413	78	–10	31
Brick, pottery, and other clay products.	130	33	128	68	34	31
Lumber	7	23	65	14	5	– 5
Boxes, wooden		59	163		–18	0
Paper and pulp	286	150	219	41	9	31
Boxes, paper	.	107	724	76	3	39
B. Machinery and equipment—						
Foundries and machine shops.	. .	77	462		–17	37
Machine tools	.		.		–31	47
Textile machiney and parts	.	.	.		–12	48
Engines, steam, gas, and water	.	.	...	..	–34	18
Pumps, steam and power.	.	.	.	. .	12	74
Electrical machinery and appliances	...	471	1,252	.	13	35
Agricultural implements	...	–38	63	.	–47	–10
Steam fittings, heating apparatus, and gas and oil stoves.	.	415	1,600	..	38	77
Plumbers supplies.	...	315	1,019	.	145	185
Tools, n.e.s.	. .	234	573	. .	–29	16
Hardware	. .	98	337	...	23	47
Cash registers and calculating machines	...	544	946	...	–20	– 4
Typewriters and supplies	...	245	586	...	– 4	19
II. Consumers' goods:						
A Food, drink, and tobacco—						
Slaughtering and meat packing	74	76	420	6	–25	23
Flour milling	4	0	0	–12	–29	–24
Bread and bakery products	....	169	913	....	14	37
Food preparations, n.e.s.	..	252	1,183	....	– 5	32
Butter, cheese, and condensed milk	287	123	128	32	–17	20
Canning and preserving, fruits and vegetables	524	92	463	55	17	14
Sugar	350	58	85	48	29	10
Confectionery and ice cream	....	233	1,435	....	–10	60
Chocolate and cocoa products		443	2,016	...	–22	74
Manufactured ice	836	266	824	44	–17	62
Mineral and soda waters	....	124	683	...	13	51
Malt liquors and cereal beverages	...	–78	–46	...	–75	–67
Cigars	32	0	145	– 8	–16	–14
Cigarettes	2,038	320	1,800	51	–14	12

TABLE 17.—(*Continued*)

Industry	1899–1925			1919–1925		
	Quantity of output	Wage earners	Horse power	Quantity of output	Wage earners	Horse power
B Clothing and clothing materials—						
Cotton goods	76	52	184	18	3	22
Woolen and worsted goods	60	31	144	14	− 1	22
Silk goods	322	103	144	37	5	22
Knit goods	154	123	213	13	8	18
Dyeing and finishing textiles		138	266	. . .	27	58
Men's clothing		45	238	.	0	11
Shirts	. . .	37	96	. . . .	27	− 7
Men's furnishings	. .	120	580	. . .	4	− 6
Women's clothing	.	52	146	.	−23	−25
Millinery and lace goods	.	221	551	. . .	6	− 3
Leather tanning	5	2	152	−16	−27	2
Boots and shoes	48	46	194	− 2	− 2	20
C. Other consumption goods—						
Furniture	.	105	248	. . .	29	52
Carpets and rugs	−5	19	139	38	48	68
Phonographs	530	789	4,132	−57	−61	14
Pianos	. .	−6	30	−10	−13	− 6
Photographic materials	. . .	328	1,434	.	−14	82
Toys and games	. . . .	330	559	. . . .	1	44
III. Miscellaneous industries:						
Automobiles	151,850	19,028	37,074	204	24	117
Rubber goods	. . .	424	1,197	59	− 8	57
Railroad cars	−27	60	590	−27	− 4	46
Locomotives		. . . .	. . .	−62	−52	18
Ship and boat building	−22	7	288	−93	−87	−45
Printing and publishing newspapers and periodicals	. . . .	29	240	. . .	2	23
Printing and publishing: book and job	. . . .	100	360	. . . .	10	29

fewer number of employees, and horse power because the amount installed does not measure the amount of power actually used. Supplemented, however, by a variety of data regarding particular commodities, these figures give a fair representation of the situation. On the whole they appear to show that staple consumers' goods have had no great increase, as indicated by the slight growth of flour milling, slaughtering, cotton and woolen goods, and clothing. In each case, however, there have been interesting developments that can be discovered only by inspection of the movements of specific goods.

Food Products.—The principal trends in food consumption have already been discussed in the preceding section, but the discussion did not include the marked developments in the tobacco industry. Here there has been a notable shift in consumption. Industries manufacturing cigars, chewing and smoking tobacco, and snuff have had practically no growth, while the output of cigarettes has expanded at a phenomenal rate. Table 18 shows the growth of these industries since 1909, the first year for which detailed separate statistics for cigars and cigarettes were available.

TABLE 18—GROWTH OF TOBACCO INDUSTRIES

	Production in millions	Number of wage earners	Primary horse power
Cigars:			
1909	6,668	129,518	[a]
1919	7,072	114,299	10,851
1925	6,501	96,036	9,271
Cigarettes.			
1909	6,819	8,159	[a]
1919	53,120	22,642	12,828
1925	79,960	21,072	15,263
Manufactured tobacco and snuff			
1909	[b]431	27,232	19,253
1919	[b]424	18,324	18,893
1925	[b]410	15,024	17,541

[a] Data not available separately

[b] Millions of pounds

In 1927 production of small cigarettes totaled over 97,000,000,000, over 25 times as many as in 1899. At the same time, only one-third more cigars were produced in 1927 than in 1899, and since 1914 there has been a slow steady decrease in the output of cigars and also of manufactured tobacco and snuff.

Textiles and Clothing.—The output of the textile and clothing group, including leather and its products, seems not to have grown as rapidly as that of other industries. It is, moreover, a general impression, supported in a measure by the available data, that there has been in these last years a relative reduction in the purchase of clothes. The total value of output of all industries engaged in the production of wearing apparel, including clothing, furnishings, millinery, knit goods, gloves, shoes, and hats, and the number of wage earners employed in these industries are shown in the following figures:

Year	Wage earners	Value of products
1914	923,105	$2,241,753,411
1919	975,780	5,524,996,224
1921	884,035	4,556,655,408
1923	998,241	5,776,522,994
1925	932,106	5,499,854,690

Although these figures are not a satisfactory measure of physical output, they indicate the failure of these industries to grow in recent years, in marked contrast to the sharp increases in output of other goods. Certain types of apparel like millinery, lace goods, and men's furnishings have grown very rapidly.

Among the textile materials, the slow growth in output of the old staples has been in part offset by the great advance in the production of silks, rayon, and knit goods, on the one hand, and by such household articles as carpets and rugs, on the other. Thus, the imports of raw silk were 50,069,000 pounds in 1919, 63,764,000 pounds in 1923, and 74,005,000 pounds in 1927. The growth of rayon consumption, as can be seen in Table 19, is astounding. In poundage, rayon consumption now exceeds that of raw silk, but in value of output it ranks still much below silk.

TABLE 19.—GROWTH OF RAYON CONSUMPTION

(In thousands of pounds)

Year	Consumption	Domestic production	Imports
1911	2,120	320	1,800
1919	9,246	8,174	1,072
1923	39,506	36,477	3,029
1925	57,343	51,902	5,441
1926	75,101	65,750	9,351
1927	96,271	80,594	15,677

Electrical Appliances.—The growing use of electricity and of electrical appliances is one of the most typical characteristics of our contemporary industrial civilization, with its tendency toward increasing mechanization and the use of labor- and time-saving devices, not only in the factory but in the home as well. The industry described in the census of manufactures as "electrical machinery, apparatus and supplies" has had a phenomenal growth in a short period. Its value of product of $92,000,000 in 1899 had risen in 1925 to $1,540,002,041, and in 1927 to $1,637,307,035, and the number of wage earners employed in it from 42,000 in 1899 to 240,000 in 1925 and 246,500 in 1927. It is, moreover, one of those industries that has grown very fast since 1919, both by the rising output of old products and

TABLE 20.—VALUE OF SELECTED PRODUCTS OF ELECTRIC EQUIPMENT INDUSTRY

(In thousands of dollars)

Class of product	1914	1919	1923	1925	1927[a]
Insulated wire and cable	69,506	128,682	184,472	210,617	209,703
Radio apparatus	792	8,075	54,000	176,990	191,228
Batteries and parts and supplies	23,402	92,463	118,066	155,248	150,216
Motors and parts and supplies	39,340	106,986	109,189	113,110	122,146
Generators, generator sets, and automotive starter motors	23,233	91,118	106,377	110,185	115,179
Telephone, telegraph, and fire alarm apparatus	24,272	50,956	97,124	87,922	119,271
Household heating and cooking appliances	3,465	38,748	63,915	75,102	72,933
Lamps, incandescent (bulbs)	17,350	57,647	71,996	73,558	87,933
Switchboards, switches, etc.	15,383	26,328	57,856	69,759	70,801
Transformers, etc.	14,514	27,061	59,115	62,153	66,611

[a] Preliminary estimate.

by the addition of new ones. Its variety is illustrated in Table 20 which shows the increasing production of selected products of the industry.

All of these figures indicate the pervasive character of electric consumption. The number of incandescent lamps produced in 1925, for example, was more than 450,000,000, in contrast with the output in 1914 of less than 100,000,000. The Census Bureau makes an annual canvass of lighting equipment for residential, commercial, industrial, street, and marine purposes, and finds the annual value of product to have increased each year beginning with 1923, when the total value was $180,000,000 and ending with 1926, when value of output had risen to $240,000,000. More important, however, is the increase in the production of electrical goods attributable to purchases by the ultimate consumer.

Here the growth has been large and variegated. The value of household electrical heating and cooking appliances was in 1914 less than $3,500,000. By 1925 the value of output had risen to $75,000,000 and included the range of appliances shown in Table 21.

TABLE 21.—PRODUCTION OF ELECTRIC HOUSEHOLD APPLIANCES

	1919	1923	1925	1927
All appliances value	$38,748,242	$63,914,810	$75,102,165	$72,933,274
Vacuum cleaners:				
Number	977,339	1,240,742	1,107,592	1,091,632
Value	$21,842,439	$35,981,514	$39,971,111	$35,120,748
Flatirons:				
Number	1,407,822	2,434,280	2,936,361	2,937,258
Value	$5,646,421	$8,198,941	$7,998,429	$7,347,563
Domestic ranges, disk stoves, hot plates etc.:				
Number	[a]	[a]	301,717	366,055
Value	$3,444,170	$3,676,645	$7,900,786	$10,299,148
Air heaters:				
Number	[a]	310,363	495,615	306,112
Value	[a]	$1,862,180	$2,027,694	$1,248.462
Percolators:				
Number	[a]	260,050	434,095	791,726
Value	[a]	$2,340,446	$3,593,496	$4,297,395
Toasters:				
Number	[a]	476,606	735,856	1,209,484
Value	[a]	$1,433,409	$1,885,780	$3,236,484
Waffle irons:				
Number	[a]	131,445	315,777	653,893
Value	[a]	$788,669	$1,864,257	$3,601,411
Grills:				
Number	[a]	184,834	209,318	196,304
Value	[a]	$923,369	$577,628	$301,541

[a] Comparable data not available.

Comparable data as to the value of electric washing machines produced are not available for all census years. The value reported for 1925 was nearly $61,000,000. The total value of all washing machines, clothes wringers and driers, and ironing machines, for domestic use, was approximately $70,000,000 in 1925, $57,000,000 in 1923, $43,000,000 in 1919, and $8,000,000 in 1914. The American Washing Machine Manufacturers' Association reports sales of washing machines, as shown in the following statement:

1923.	718,429
1924	728,901
1925	882,499
1926	1,029,053
1927	944,506

No accurate figures on the production of electric refrigerators which produce their own ice are available. It has been estimated that 365,000 electrical refrigerators, with a value of $82,000,000 were sold in 1927 as compared with 248,000 in 1926. As late as 1925, the production of ordinary refrigerators, moreover, showed no signs of being affected by the new device. In 1925 the value of product of the refrigerator industry was nearly $58,000,000, having risen to this level from $50,000,000 in 1923, $26,000,000 in 1919, and $15,000,000 in 1914.

Radio.—Probably the outstanding development in consumption in these past years has been the introduction of the radio. From a negligible figure of less than $800,000 in 1914, from only $8,000,000 in 1919 and $11,000,000 in 1921, the value of radio apparatus produced increased to $54,000,000 in 1923 and $177,000,000 in 1925. Nearly three million loud speakers, and a million and a third head sets were produced in 1925. Output of complete receiving sets was about two and a half million in 1925 as compared with less than a half million in 1923. Because of the use of separate products in making the complete sets, there is considerable duplication in the figures of total value, but the quantity figures indicate that the number of radios produced in 1925 was at least double the 1923 output. The annual statistical survey of radio retailing made by the Department of Commerce gives information regarding the number of homes equipped with radio sets on January 1 and the annual sales of radio equipment at retail, as shown in the following tabulation:

Year	Sets in use on Jan. 1 (thousands)	Annual sales at retail (thousands)			
		Total	Sets	Parts	Accessories
1922	60	$ 60,000	$ 5,000	$ 40,000	$ 15,000
1923	1,500	136,000	15,000	75,000	46,000
1924	3,000	358,000	100,000	100,000	158,000
1925	4,000	430,000	165,000	65,000	200,000
1926	5,000	506,000	200,000	50,000	256,000
1927	6,500	446,550	168,750	21,000	256,800
1928	7,500	......	......	. .	.. ...

IV. THE AUTOMOBILE[49]

The real revolution in American consumption, involving not only radical changes in ways of living but also profound industrial consequences, is in large measure a function of the introduction of the automobile. It would be difficult to find anywhere in economic history so swift and pervasive a revolution. In 1910 there was one automobile to every 265 persons in the country; in 1917 one to every 22; in 1919 one to every 16; and on July 1, 1928, one to every 6. Since 1915 the annual production of passenger cars has been well over 1,000,000 a year, and since 1922 over 3,000,000 a year. Production of cars and trucks in 1925, 1926, and 1928 exceeded 4,000,000 units annually. The following tabulation of the registration of passenger cars and trucks shows to what degree this great advance in the use of automobiles has been a postwar phenomenon.

Year	Registration[a]	
	Passenger cars	Trucks
1919	6,771,074	794,372
1920	8,225,859	1,006,082
1921	9,346,195	1,118,520
1922	10,864,128	1,375,725
1923	13,479,608	1,612,569
1924	15,460,649	2,134,724
1925	17,512,638	2,441,709
1926	19,237,171	2,764,222
1927	20,230,429	2,896,886
1928	21,630,000	3,120,000

[a] National Automobile Chamber of Commerce, *Facts and Figures of the Automobile Industry*, 1928 edition, p 6

The figures of production and registration alone are sufficient evidence that the purchase and use of automobiles is participated in by all classes of the population. The statistics of the increase in the production of cars of low, medium, and high price[50] furnish only further confirmatory evidence.

In order to throw additional light on the types of people that buy automobiles and the conditions under which they are purchased, a sample study was made from the records for deliveries at retail by a large auto-

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[49] The material for this section was prepared by Ralph C. Epstein, of the University of Buffalo. He desires to acknowledge his indebtedness to S. A. Stephens and Florence M. Clark for valuable assistance in analyzing the data in this section.

[50] Low-priced cars are defined as cars retailing at $1,375 and under; medium-priced at from $1,376 to $2,775; and high-priced at $2,776 and over.

TABLE 22.—ANNUAL PRODUCTION OF PASSENGER CARS, BY PRICE CLASSES[a]

Year	Number of cars		
	Low-priced cars	Medium-priced cars	High-priced cars
1907	13,285	14,427	8,672
1908	19,072	16,618	7,471
1909	56,284	38,625	29,939
1910	89,113	63,113	17,997
1911	95,536	48,134	18,506
1912	139,615	64,869	17,533
1913	262,867	109,251	20,086
1914	437,661	82,872	17,997
1915	657,695	207,507	15,287
1916	1,299,206	113,858	16,488
1917	1,588,100	156,436	21,253
1918	816,076	103,678	21,766
1919	1,201,586	359,882	37,067
1920	1,283,656	495,935	99,978
1921	1,049,666	306,563	96,252
1922	1,825,888	465,526	80,100
1923	2,999,205	562,127	64,610
1924	2,744,171	428,079	49,854
1925	2,992,176	701,106	71,717
1926	3,271,015	508,023	77,965

[a] Ralph C. Epstein, *The Automobile Industry Its Economic and Commercial Development*, 1928, pp 340–341, 344–345.

mobile distributor in an eastern industrial city with a population of over a half million, for the period from April 6, 1928, through June 15, 1928. The records included both the sales made by the distributor in the city in which the business is located and those made by a half-dozen or more subdealers doing business in surrounding small cities and towns. The make of the car to which the figures pertain is a popular one, selling in different chassis types which range in price roughly from about $1,000 to $1,600. The bulk of the sales are in models which, with full equipment, deliver at approximately $1,100. The data are believed to afford a more or less typical cross section of the automobile market, except for purely agricultural localities. In order to obtain as accurate a picture of the channels of consumption as possible, commercial cars and passenger cars sold to corporations were excluded from the figures. The purchasers were then classified among the groups shown in Table 23. Where it was not clear from the original record to which group a listed occupation belonged, the procedure was followed of assigning the name to the higher of the two groups in question.

It is clear that a large proportion of the current purchases of passenger automobiles is made by the members of the wage-earning and lower salaried groups. These groups, moreover, apparently make substantial

TABLE 23.—SUMMARY OF SALES OF A MEDIUM-PRICED CAR, CLASSIFIED ACCORDING TO OCCUPATIONS OF PURCHASERS, NATURE OF CAR TRADED IN, AND TERMS OF PAYMENT (APRIL, MAY, JUNE, 1928)

Group	Terms	Trading in—		No trade	Subtotal	Total
		Same or better car	Cheaper car			
		Per cent	*Per cent*	*Per cent*	*Per cent*	*Per cent*
Manufacturers, capitalists, bankers, brokers, merchants	Cash	5.4	0.6	2.5	8.5	18.2
	Time	5.8	1.1	2.8	9.7	
Professional classes. Physicians, lawyers, teachers, engineers, etc	Cash	2.1	1.7	0.6	4.4	9.4
	Time	2.5	0.8	1.7	5.0	
Subexecutive classes: Superintendents, foremen, etc.	Cash	3.1	0.7	0.8	4.6	9.6
	Time	1.9	1.4	1.7	5.0	
Salesmen and clerks	Cash	3.0	0.6	3.3	6.9	20.2
	Time	5.8	0.6	6.9	13.3	
Policemen, firemen, chauffeurs, motormen, etc	Cash	1.2	0.3	0.2	1.7	5.0
	Time	1.0	0.6	1.7	3.3	
Laborers and artisans	Cash	2.8	1.4	3.0	7.2	23.6
	Time	5.6	3.9	6.9	16.4	
Housewives	Cash	1.1	0.0	0.8	1.9	4.7
	Time	1.1	1.1	0.6	2.8	
Farmers	Cash	0.8	0.6	0.0	1.4	3.4
	Time	0.6	0.6	0.8	2.0	
No occupation given	Cash	1.4	0.3	0.3	2.0	5.9
	Time	2.0	1.1	0.8	3.9	
Total		47.2	17.4	35.4	100.0	100.0

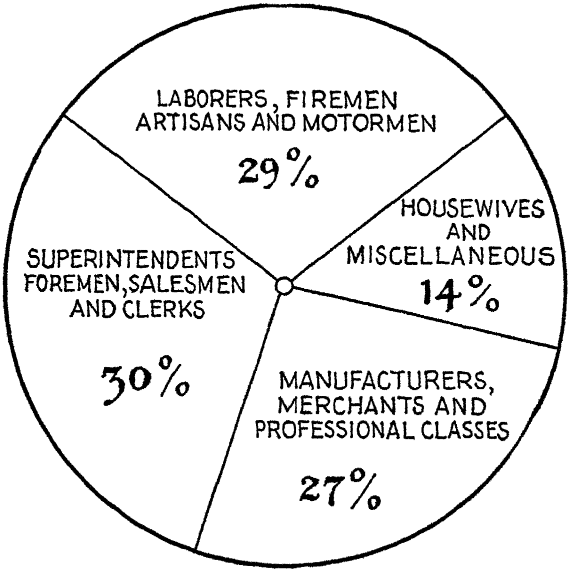
purchases by cash payment. In the labor and artisan group, also, the total number of sales involving no trades and the number involving the trading in of cheaper cars were nearly twice as great as the number of sales in which the same or better cars were turned in. For all the groups together, it is seen that 38.6 per cent of the total sales were made for cash and 61.4 per cent on time. As was to be expected, the proportion of cash buyers was larger among persons having cars to trade in than among those who bought new cars outright. It should be noted in this connection that while, in the groups of manufacturers, merchants, professionals, and subexecutives, the number of installment sales was almost matched by the number of cash sales, the ratio of installment to cash sales in the groups of salesmen, clerks, firemen and policemen, and laborers and artisans is more than two to one.

In the tabulation of these figures, numerous cash purchases by carpenters and machinists were noticed. Sometimes these sales involved the trading in of other cars, of which the following transactions are typical: a 1925 Ford, on which the allowance was $120; a 1924 Dodge with an allowance of $195, both sales being to carpenters. The new cars cost approximately $1,100, so that the cash balance paid in each case was over $900. Again, carpenters, machinists, crane operators, compositors, bricklayers, waitresses, and laborers are all listed as buyers of new cars who not only paid cash for them, but had nothing to trade in with which to reduce the amount of cash they required.

While it is, of course, the case that both the initial price and the running expenses of automobiles have been much reduced in the past few years, both items still involve substantial expenditure. It has been estimated[51] that a typical 4-cylinder closed car of from 106- to 110-inch wheel base which cost $1,500 in 1913, could be bought for $760 in 1920 and $600 in 1927. These comparisons take into consideration the change in the purchasing power of money, but cannot adequately reflect the fact that the car of 1927 is a product vastly superior to the car of 1913 or even 1920.

CHART 1—PECENTAGE DISTRIBUTION OF PASSENGER CAR SALES IN A PRIMARILY URBAN COMMUNITY, FOR APRIL, MAY, AND JUNE 1928

(See text for nature and source of data)



V. HOUSING[52]

We have since 1917 passed through two distinct phases in our residential housing situation. The first, which ended generally in 1922, was characterized by war restrictions on building, a great flow of population into the cities, severe shortage of housing, and considerable legislation designed to control the rise of rents. The second phase, which began in 1922 and has apparently not yet ended, was marked by unprecedented building activity affecting all types of buildings. The analysis of these changes in large statistical terms and the determination of their effects on the average general standard of housing in the country, involves comparison with past standards and not the discovery in the population of important groups whose housing facilities are below any of the requirements of decency and health. Unquestionably there are such groups, but the data regarding them are not well known. Whether their number, in the past decade, has been reduced cannot be determined, except by inference. Important as this question is, no extensive facts on it are available, and it is, consequently, considered here only as an incident in the general trend of housing standards.

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[51] By Ralph C. Epstein.

[52] The material for this section was prepared by Maurice Leven, Statistician, New York State Board of Housing. See also Chap. III, Construction, and Chap. V, Marketing.

The simplest measure of housing conditions is the physical supply of housing space, since housing standards may be expected to be better when there is an abundance than when there is a shortage of houses. No basic data exist which would permit reliable estimates of the total supply of housing in the United States, but estimates of the volume of residential construction will, over a period of time, serve as a reasonably accurate index of changes in the supply of housing. This volume has increased very rapidly since 1922. During the war, however, there was an appreciable reduction in building, and the problem of weighing the significance of the postwar increase is complicated by the necessity of determining the degree to which the recent gains in building only make up the war losses.

To determine how far the war shortage has been met by the recent construction, it is necessary to compare the present volume of construction with normal requirements. For this purpose it may be assumed that, except for temporary maladjustments, the population is usually adequately housed, in accordance with existing standards. Normally, therefore, construction is carried on chiefly to take care of the increase in population. Only a small fraction of new construction is necessary for replacements. On this basis it is fair to compare residential construction with population growth. Cumulative series of both population growth and the volume of construction, in which annual irregularities are smoothed out, should afford the proper material for such a comparison.

These cumulative data for the period since 1913 are presented in Table 24. In the four years prior to the American entry into the World War, there was an average construction of 209 square feet per person added to the population. When the war years are included, this average drops to 205 square feet. The postwar boom of 1919 not only wiped out all the shortage created during the war but raised the average to nearly 221 square feet. Then followed another two years with a low construction record, which again brought the average below the level established in the four years from 1913 to 1916. But, beginning with 1922, construction began a consistent upward movement, and by the end of 1927 the average residential construction per person added to the population was more than 286 square feet.

TABLE 24.—ESTIMATED RESIDENTIAL CONSTRUCTION IN THE UNITED STATES AND INCREASE OF POPULATION

Year	Residential construction (thousands of square feet)			Cumulative figures beginning with 1913		
	Reportable to F. W. Dodge Corporation in F. W. Dodge territory (eastern states)		Total United States[a]	Total residential construction (thousands of square feet)	Increase in population (thousands)	Residential construction per person added to population (square feet)
	27 states	36 states				
1913		[b]215,087	307,268	307,268	2,069	148.5
1914		[b]225,155	321,650	628,918	3,566	176.4
1915		[b]245,220	350,314	979,232	4,911	199.4
1916		[b]259,181	370,259	1,349,491	6,446	209.4
1917		[b]165,595	236,564	1,586,055	7,708	205.8
1918		[b]94,440	134,914	1,720,969	8,380	205.4
1919	[c]241,880	[d]273,324	390,463	2,111,432	9,566	220.7
1920	[c]137,524	[d]155,402	222,003	2,333,435	11,267	207.1
1921	[c]204,575	[d]231,170	330,243	2,663,678	12,990	205.1
1922	[c]311,407	[d]351,890	502,700	3,166,378	14,543	217.7
1923	[c]354,257	[c]392,747	561,068	3,727,446	16,521	225.6
1924	[c]371,068	[c]422,285	603,264	4,330,710	18,148	238.6
1925	[c]470,207	[c]540,509	772,156	5,102,866	19,679	259.3
1926	[c]450,249	[c]498,927	712,753	5,815,619	21,152	274.9
1927	[c]434,956	[c]474,276	677,538	6,493,157	22,665	286.5

[a] According to Mr. Thos. S. Holden, Chief Statistician, F. W. Dodge Corporation, the 36 states of the F. W. Dodge Corporation territory comprise seven-eighths of the total construction of the United States and the class of contracts reportable to F. W. Dodge Corporation constitutes about 80 per cent of the total. The estimates appearing in this column are an outgrowth of Mr. Holden's kind assistance. However, he is not responsible for any shortcomings in method or any errors. The estimates are necessarily rough.

[b] Estimated on basis of enameled baths shipments.

[c] Contracts awarded, as reported by F. W. Dodge Corporation—monthly averages for each year appear in *Survey of Current Business*.

[d] Estimated on basis of enameled baths shipments and F. W. Dodge Corporation figures for 27 states.

It is possible, moreover, to push the analysis of the supply of housing a step further. Table 25 represents an attempt to measure the excess or deficiency, with reference to normal requirements, in actual construction for each year from 1917 to 1927. The construction during the seven years, from 1910 to 1916 inclusive, has been taken as approximating the prewar normal. In that period residential construction amounted to roughly 220 square feet of floor area per person added to the nonfarm population.[53] Multiplying the increase in nonfarm population, shown in Column A of Table 25, by 220, we obtain the figures of normal building requirements, shown in Column B. The difference between actual construction and these normal requirements is here regarded as the measure of shortage or surplus.

[53] The nonfarm population is here used because the bulk of construction in recent years was for this class of the population.

TABLE 25.—CUMULATIVE DIFFERENTIALS OF RESIDENTIAL BUILDING CONSTRUCTION ABOVE OR BELOW PREWAR NORMAL REQUIREMENTS, 1917–1927

Year	Cumulative nonfarm population increase (thousands)	Normal building requirements[a] (millions of square feet)	Actual construction (millions of square feet)	Differential construction above or below normal[b]		
				Millions of square feet	Per cent of prewar normal requirements	Surplus persons provided for (thousands)
1917	1,283	282	237	−45	−16.0	−205
1918	1,965	432	372	−60	−13.9	−273
1919	3,157	695	762	67	9.6	305
1920	4,892	1,076	984	−92	−8.6	−418
1921	6,675	1,469	1,314	−155	−10.6	−705
1922	8,298	1,826	1,817	−9	−0.5	−41
1923	10,376	2,283	2,378	95	4.2	432
1924	12,115	2,665	2,981	316	11.9	1,436
1925	13,764	3,028	3,753	725	23.9	3,295
1926	15,357	3,379	4,466	1,087	32.2	4,941
1927	16,970	3,733	5,144	1,411	37.8	6,414

[a] 220 square feet of floor area per person of nonfarm population increase. This is approximately the average amount built during the seven-year period preceding the entry of the United States into the World War, 1910–1916 inclusive.

[b] A minus sign (−) indicates below normal.

So measured, the volume of construction during and immediately after the war was apparently not seriously below normal requirements. At no time did construction fall more than 16 per cent of the prewar normal,[54] and since 1923 there has been a rapid accumulation of new residential buildings. If it be assumed that, at the end of 1916, there was neither a deficiency nor a surplus, the accumulation above normal requirements reached 1,411,000,000 square feet of floor area in 1927. This amount of space is sufficient to accomodate, at the prewar rate of 220 square feet per person, a surplus in population of about 6,400,000. This does not mean that there is at present an oversupply, since the standards of housing have, meanwhile, steadily advanced. Much of the old type of housing has become obsolete and either remains vacant or has been demolished.[55]

The Quality of New Residential Construction.—Lacking any other simple and equally satisfactory test of quality, probably the best measure of it is cost. Estimates of cost are based on the value of contracts awarded in 27 eastern states, as reported by the F. W. Dodge Corporation. The value per square foot of floor area is shown in Table 26 in terms of both current and 1913 dollars. The figures show an unmistakable and substantial rise from 1923 on. This means, of course, that on the average more and more expensive homes have been built since 1920. Some of this, however, is owing to the change in the type of buildings now erected. There has, in recent years, been a marked disproportionate increase in the construction of multifamily or apartment houses. These require more expensive materials and construction than single-family frame houses, and the cost per square foot of floor area of the mere shell is accordingly higher.

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[54] The war housing shortage was probably particularly acute because it was concentrated in the larger cities and there caused serious congestion.

[55] See Obsolescence, Chap. III, Construction, p. 226.

TABLE 26—VALUE PER SQUARE FOOT OF RESIDENTIAL BUILDING CONTRACTS AWARDED IN 27 EASTERN STATES, 1919–1927

Year	Value per square foot of floor area		Year	Value per square foot of floor area	
	Current dollars[a]	Dollars of 1913 value[b]		Current dollars[a]	Dollars of 1913 value[b]
1919	3 51	1 72	1924	4 97	2 38
1920	4 12	1 60	1925	5 02	2.47
1921	4 29	2 11	1926	5 20	2.60
1922	4 33	2 35	1927	5 35	2 64
1923	4 47	2 14			

[a] Based on F. W Dodge Corporation statistics

[b] Deflated by means of index of cost of construction

Sanitary Equipment.—Some suggestion of the advance in the equipment of the modern American house has already been had from the survey of the consumption of manufactured goods. The varied list of commodities and appliances which appear to make the difference between what people regard as convenient, comfortable, and healthy living and the reverse are considered in some further detail. The actual status of sanitary equipment in American homes is shown in Table 27.

TABLE 27.—SANITARY EQUIPMENT OF HOMES IN URBAN COMMUNITIES,[a] 1925–26

Sanitary home equipment	Per cent of dwellings equipped	Size of sample	
		Number of dwellings (thousands)	Number of communities
Stationary kitchen sinks	83.9	3,909	1,454
Flush toilets	82.2	3,311	1,301
Stationary bathtubs	68.3	2,246	1,155
Stationary wash basins	71 3	2,112	1,084
Stationary laundry tubs	28.3	1,943	1,031

[a] Results of Urban Home Equipment Survey (1925–26), General Federation of Women's Clubs. This survey was made under the direction of the Industrial Survey and Research Service, Washington, D. C

TABLE 28.—NUMBER OF SANITARY BATHTUBS, TELEPHONES, AND WIRED HOMES COMPARED WITH TOTAL NONFARM POPULATION, 1913–1928

Year (Jan. 1)	Estimated[a] nonfarm population	Homes equipped with stationary bathtubs		Residence telephones Bell System		Wired homes (domestic electric light and power customers)	
		Total number[b]	Number per thousand nonfarm population	Total number[c]	Number per thousand nonfarm population	Total number[d]	Number per thousand nonfarm population[e]
	Thousands	*Thousands*		*Thousands*		*Thousands*	
1913	64,545	7,066	109.5	2,800	43.4	3,101	48.0
1914	66,534	7,520	113.0	3,050	45.8	...	...
1915	68,021	8,004	117.7	3,275	48.1	...	...
1916	69,376	8,540	123.1	3,500	50.4	...	...
1917	70,941	9,123	128.6	3,864	54.5	5,260	74.1
1918	72,223	9,501	131.6	4,148	57.4	5,800	80.3
1919	72,905	9,722	133.4	4,228	58.0	6,900	94.6
1920	74,097	10,116	136.5	4,545	61.3	8,010	108.1
1921	75,832	10,702	141.1	4,903	64.7	8,700	114.7
1922	77,615	11,175	144.0	5,260	67.8	9,430	121.5
1923	79,238	12,028	151.8	5,653	71.3	10,211	128.9
1924	81,316	13,059	160.6	6,230	76.6	11,819	145.3
1925	83,055	14,150	170.4	6,798	81.8	13,567	163.3
1926	84,704	15,410	181.9	7,306	86.3	14,965	176.7
1927	86,297	16,545	191.7	7,875	91.3	16,359	189.6
1928	87,910	17,591	200.1	8,333	94.8	17,596	200.2

[a] Based on W. I. King's estimates of total population and census figures of farm population (1920 and 1925).

[b] Estimated on basis of percentage of homes having stationary bathtubs in 1925 as determined by Urban Home Equipment Survey of General Federation of Women's Clubs, and shipments of enameled baths.

[c] Courtesy of S. L. Andrew, chief statistician, American Telephone and Telegraph Company. According to Dr. Andrew, in addition to the telephones in the Bell System, there are (July, 1928) some 4,800,000 telephones which are operated by other companies, about two-thirds of which are residence telephones.

[d] Compiled and estimated by G. F. Wittig, statistical editor, (*Electrical World*, Jan. 7, 1928, p. 32).

[e] The number of farm electric light customers is comparatively small. The statistics of wired homes are therefore almost 100 per cent nonfarm. Of the total of 11,814,000 customers at the beginning of 1924, only 165,000 or about 1.4 per cent were farmers (National Electric Light Association, *Facts and Figures*, March, 1928, p. 21). By now the number of farmer customers may have increased to about 300,000. But this is still less than 2 per cent of the total. Consequently, the error introduced by using total electric light customers in computing the rate per 1,000 nonfarm population is negligible. It should be stated that the number of electrified farms is greater than is indicated by the figures just discussed. These figures do not include farms with independent generating units. Of these, there were about 300,000 at the end of 1923.

In 1925, according to this survey, 68.3 per cent of the urban homes had stationary bathtubs. On the basis of this percentage it is estimated that, at the beginning of 1925, there were about 14,100,000 stationary bathtubs in the homes of the nonfarm population of the United States.

This figure was projected back for each year from 1913 on, and further estimates were made for the years since 1925 by the use of the statistics of the annual shipments of enameled baths. Of the 11,000,000 baths installed during the 15 years since 1913, only slightly more than 4,000,000 were installed during the first nine years and 7,000,000 in the six years beginning with 1922. The rate of installation was, thus, 1,100,000 a year during the second period and 480,000 in the first.

Residence Telephones and Wired Homes.—According to reliable estimates there are at present about 11,530,000 residence telephones in the United States, or about one telephone for every 2.5 residences. Between 1918 and 1928 the number of residence telephones of the Bell System more than doubled. At the same time the nonfarm population, which is in the main served by the Bell System, increased only 21.5 per cent. The progressive electrification of American life has already been discussed in an early section of this chapter. Further data are presented in Table 28 on page 67.

The number of resident customers of electric light and power companies in the United States rose from 3,100,000 in 1913 to 17,600,000 in 1928. In 1913 there were only 48 wired homes per 1,000 nonfarm population; by the end of 1927 this number had risen to 200. Counting only four persons to the family, the degree of electrification of American homes, exclusive of farms, has reached 80 per cent. Assuming the standard family of the 1920 census, this percentage would be 86 as contrasted with 20 in 1913.

Household Appliances and Furnishings.—The foregoing picture of the advance in the quantity, quality, and equipment of American housing since 1922 is not complete without at least some reference to the variety of goods that are for convenience included in this last category. The radio and the many types of household electrical appliances have been described before. The remaining group of household goods, included in Table 29, shows, except in the case of the piano and the phonograph, a

TABLE 29.—ADJUSTED[a] VALUES OF DIFFERENT HOUSEHOLD GOODS MANUFACTURED IN THE UNITED STATES

(Millions of 1913 dollars)

Goods	Census year			
	1919	1921	1923	1925
Phonographs	86	50	59	36
Pianos	58	38	61	60
Household furniture	274	238	317	373
Oilcloth, linoleum, and asphalted-felt-base flooring	37	32	52	56
Woolen carpets and rugs	67	53	109	112

[a] Value of product as reported in the Census of Manufactures divided by wholesale price index of household furnishing goods of the United States Bureau of Labor Statistics.

substantial per capita advance. In the period from 1919 to 1925, when population was not growing fast and when there was no material change in the export and import of these wares, the deflated value of output of household furniture increased 36 per cent, of oilcloth and linoleum products 51 per cent, and of carpets and rugs 67 per cent.

Water Consumption.[56]—Water consumption appears to be not only an interesting index of the sanitary standard of living in the United States, but the comparative data throw considerable light on the variation in sanitary standards in the United States and in Europe. Although the statistics of the per capita daily consumption of water are hard to subject to refined interpretation, because they vary with the degree of control over the water supply, either through the use of meters or through the scarcity of water, and because it is generally not possible to separate the domestic from the industrial consumption, the disparities between prevailing American and foreign conditions are so marked as to command attention. Table 30, showing the per capita daily water consumption in selected American and European cities, illustrates the striking differences in levels. While some of the large variations among the American cities are due to the presence or absence of meters or the different proportions of industrial and domestic consumption, it is nevertheless the fact that

TABLE 30.—DAILY PER CAPITA WATER CONSUMPTION, IN SELECTED AMERICAN AND EUROPEAN CITIES

Country and city	Year	Per capita daily consumption of water
		U. S. gallons
Germany:		
Berlin	1927	37.8
Hamburg	1927	37.0
England:		
London	1927	43.4
Manchester	1927	42.3
France. Paris	1927	47.2
Holland:		
Amsterdam	1926	30.0
Rotterdam	1926	35.0
United States:		
Baltimore	1927	129.0
Chicago	1927	292.8
Cleveland	1927	127.9
Detroit	1927	126.0
New York	1927	142.0
Philadelphia	1927	168.0

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[56] The material on water consumption was prepared by Abel Wolman, Chief Engineer, Maryland State Department of Health, and Editor, *Journal of the American Water Works Association.*

domestic consumption is from two to three times that of the cities of Europe.[57]

Analysis of changes in the per capita consumption of water over a period of years is almost impossible because of the confusing factors that have already been mentioned. The chief engineer of the New York City Bureau of Water Supply has, however, furnished the figures of per capita daily water consumption for domestic and public use, excluding industrial use, in New York City from 1910 to 1926. They are as shown, in U. S. gallons, in the following tabulation:

Year	Daily per capita consumption	Year	Daily per capita consumption
1910	79.1	1919	88.3
1911	72.9	1920	98.5
1912	72.4	1921	96.9
1913	69.8	1922	97.1
1914	77.5	1923	95.8
1915	74.6	1924	96.9
1916	78.9	1925	103.5
1917	82.7	1926	103.2
1918	90.5		

The fluctuations from year to year, sometimes great, are the result of numerous temporary and accidental factors. The increase in recent years since 1918 is in part a reflection of the growth of building and of sanitary equipment. The quick and unusual rise in 1920 was in part due to the abnormally cold winter of 1919–20, and the rise in 1925 in part to an unusually hot summer.[58]

VI. THE STANDARD OF LIVING OF THE FARM POPULATION[59]

The urban and industrial and commercial prosperity in the United States for the past seven years has not had its counterpart among our farm population. The peculiar economic problems of American agriculture are the subject of comprehensive analysis elsewhere in this survey.[60] Here it is proposed to deal mainly with those items that throw light on the farmers' standard of living in the years following the close of the World War. The difficulties that are always encountered in measuring the standard of living of any population are even greater in assessing the changing status of the farm population. Direct budgetary studies of farmers' incomes and expenditures are of very recent origin. The studies since 1919 are not annual and do not cover identical families in representative agricultural sections. The answer to the important question whether the increase, between 1920 and 1925, of half a billion dollars in the mortgage indebtedness on farms owned by their operators was largely due to the turning of floating debts, incurred for family subsistence, into land mortgages is not known. We are, consequently, thrown back on various criteria of prevailing and past standards which, while inadequate, are informative.

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[57] It is interesting to point out in this connection that a daily per capita consumption of 400 gallons in Beverly Hills, California, is said to be the highest in the country. The water system there is 100 per cent metered, and the consumption of water is virtually all domestic. The large per capita use is explained by the unusually high proportion of baths, private swimming pools, and lawn area.

[58] Letter from William W. Brush, Chief Engineer, New York City Bureau of Water Supply.

[59] The material for this section was prepared by C. J. Galpin, Economist in charge, Farm Population and Rural Life, Bureau of Agricultural Economics, United States Department of Agriculture.

[60] See Chap. VIII, Agriculture.

Defining farm population as "all persons living on farms" and applying to this population such evidences of changing standards of living as the movement of population from and to the farms, changes in farm income and expenditures, and the purchasing power of farm products, it is possible to reach some conclusions regarding the character of farm living standards since 1919.

There are and have been among American farmers two levels of standards of living, an upper and a lower level, each the product of historical conditions that have distributed our farm population on good and poor land. The standards of both have been substantially maintained since 1919, on the one hand, because the reduction in farm population has left a smaller number of persons to live on the products of farm labor and, on the other, because the farmers have drawn upon savings, credit, and mortgage debt to protect the standards to which they had become accustomed. Farmers have shared with the rest of the population the benefits of invention and new goods, which have been already described. For the future, finally, the farmers on poor land face the very difficult problem of improving their present material standards.

Classification of Farm Population.—In 1925 the total farm population in the United States was 28,981,668. Of this total, 38.5 per cent lived on farms, in counties where the average value per acre for the farm land and buildings was under $40; 61.5 per cent, on farms averaging in like manner $40 and over. The first type may properly be regarded as poor land and the second as good land. The farm population, therefore, falls into two classes, the one on the lower level working poor land, and the other, on the upper level, working good land. If the farm population living on the poor land were all on farms of comparatively the same acreage, the handicaps of poor land would be more or less equally distributed. As it is, the farms on poor lands in the eastern sections of the United States are on the average relatively small, while those on poor land in other sections, notably the western mountain areas, are relatively large. The farm population may, therefore, again be divided into two classes, the first consisting of all persons who live on farms of which the average value per farm of the land and buildings is under $4,000, and the second of all persons who live on farms with an average value of $4,000 and over. By this classification, 42.2 per cent of the total farm population live on low-value farms and 57.8 per cent on high-value farms. It appears fair to say that the farm population of the United States is made up of two classes, possessing different standards of living, due in the main to historical differences in soil, topography, and income.

Those who live on low-value farms have customarily eked out a small farm income by hiring themselves out for wages off the farm. In a sample study of 300 farm families in counties of the low-value class, the average gross cash income from the farm was $804, while farm expenses were $580, leaving a surplus for living expenses of only $224. The farm itself in rent, garden, grains, etc., contributed an estimated income of $401, and outside work of members of the family added $321 in wages. The farm does not support the family. From 1919 to 1927 this class of the farm population has not improved its standard of living, but its standard appears also not to have suffered much of a decline.

The Movements of Population between Farms and Cities.—The movement of population from and to the farm may be regarded as one index of the relative economic and social status of agriculture. Unfortunately our information on this matter does not extend far back. For the more recent years the United States Department of Agriculture has made estimates of the net movement from farms to cities and of the net loss in farm population since 1910. In recent years there has been an annual movement from farm to cities of approximately 2,000,000 persons and a return movement of considerably more than 1,000,000 persons. The estimated net loss in farm population,[61] resulting from this excess migration into cities, during the total periods 1910–1920 and 1920–1925 and in the calendar years 1925, 1926, and 1927 is shown in the following statement:

1910–1920	(estimated)	463,000
1920–1925	(U. S. Census enumerations)	2,000,000
1925	(estimated)	441,000
1926	(estimated)	649,000
1927	(estimated)	193,000

Analysis of these figures indicates that there are four streams of persons away from farms. There is the stream of young adults, male and female, ready for city careers; the stream of older adults, still vigorous in mind and body, seeking better returns than they received from farming; the prosperous adults of middle age turning to the city for standards of consumption not possible on the farm; and the adults forced by age and heavy work to abandon farming. Further light is thrown on this movement by a study of the United States Department of Agriculture of a representative sample of several thousand migrants between 1919 and 1926.[62] The study shows that of those leaving the farm for the city 38 per cent moved on account of economic distress, 25 per cent by reason of physical disability, 11 per cent to find better educational facilities for their children, and 2.5 per cent to enjoy the comforts of the city. Of those who left the city to return to farms, 87 per cent had either farmed before as owners, tenants, or hired men, or had been farm born and farm reared. Of all who returned to the farm, 27 per cent gave as their reason healthier living conditions for their families, 30 per cent the high cost of living and lack of steady employment in cities, 20 per cent dislike of city work and life, and 7 per cent the freedom and independence of farm life.

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[61] Net loss equals the number of persons leaving farms for cities added to the number of persons who died, and from this sum is taken the number of persons going to farms from cities added to number of births.

It is seen from these data that over one-third of those who left farms did so because they could not make ends meet through farming. Thus, the pressure of competition has forced out some of the inefficient and unfortunate. The more efficient remained and weathered the storms, maintaining their standards through income, savings, or credit, or by reducing them where neither health nor present social status was impaired.

Detailed Studies of the Farmers' Standard of Living.—The United States Department of Agriculture, in co-operation with the state colleges of agriculture, has made detailed studies[63] of the annual family consumption and expenditures of 5,000 farm families situated in 15 states. These consumption studies began in 1919 and continued year after year till 1928. The 15 states are as follows: New Hampshire, Vermont, Massachusetts, Connecticut, New York, Kentucky, Tennessee, South Carolina, Alabama, Texas, Missouri, Kansas, Iowa, Ohio, and Minnesota. The studies are regionally representative of the United States, with two exceptions, *viz.*, the Mountain and Pacific sections, which contain, however, only about 7 per cent of the total farm population. The studies are highly representative also of the farm families living in counties, where the average value per farm and per acre of land and buildings is on the upper level. In fact, a part of the studies will well represent the farm population of the upper level of agriculture (upper incomes, upper values of land and buildings per acre, upper value per farm); while another part will represent, though not so fully or so convincingly, the lower level of agriculture, mainly because fewer studies in the lower level of income and land values have been made. There is no doubt, however, as to the approximately representative character of the results presented in this lower level.

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[62] "Analysis of Migration of Population to and from Farms," (mimeograph report).

[63] Department *Bulletins* Nos. 1214, 1382, 1466: mimeographs of years, 1925, 1927, 1928.

The upper level covers, it will be recalled, 57 8 per cent of the farm population of the United States, when we take the total farm population of all the counties whose farm values average, per county, the sum of $4,000 and over. For this class in the year 1919, the average total expenditures of 861 families situated in three states was $1,436; in 1921, the average for 402 families in one state was $1,979; in the years 1922-1924, the average for 2,886 families in 11 states was $1,597 50; in 1924, the average for 25 families in one state was $1,329 20. It is well to remember at this point that in counties where the average level of land and farm values is high, due to soil and topography, there will be families with a variety of incomes from the low to the high. These studies took a representative sample of each county and so took all grades of families. For example, in the 1919 study of 861 families, although the average expenditure was $1,436, there were 7 families with expenditures below $300; 69 families with expenditures from $300 to $599; 191 families, from $900 to $1,199; 138, from $1,200 to $1,499; 104, from $1,500 to $1,799; 87, from $1,800 to $2,099; 55, from $2,100 to $2,399; 34, from $2,400 to $2,699; 10, from $2,700 to $2,999; 38, $3,000 and over. Likewise, in the 1922-1924 studies in 11 states in which the average expenditures were $1,597 50, there were 58 families with expenditures below $600; 280, from $600 to $899; 579, from $900 to $1,199; 614, from $1,200 to $1,499; 492, from $1,500 to $1,799; 332, from $1,800 to $2,099; 196, from $2,100 to $2,399; 116, from $2,400 to $2,699; 83, from $2,700 to $2,999; 136, $3,000 and over.

The distribution of expenditures among the various elements of living shows significant change. The percentages of the total budget assigned to food and clothing are fairly constant in all the regions in all the years; housing (estimated arbitrarily at 10 per cent of the value of the house) varies from a low of $94.60 in 1924 and $137 in 1919, to a high of $234 in 1921 and $199.60 in 1922-1924. The element of advancement (which includes expenditures for education aside from taxes, for churches, benevolences, recreation, and reading) varies from a low of $45.10 in 1925 and $84.30 in 1919 to a high of $255 in 1921 and $104.80 in 1922-1924.

One noteworthy result of this study of 2,886 families are the figures of the annual cost of the use of the automobile for household purposes. The average cost of the use of the automobile per family varies from $56.90 in the New England states to $68.70 in the Southern states and to $93.30 in the North Central states. It should be noted that these costs are averages for all families in each section and therefore do not represent the actual cost (for household purposes), since not all the families reported use of the cars. Of the 317 families of New England, 167, or 52.7 per cent, reported the ownership and use of an automobile. For the 167 families owning and using cars, the expenditures amounted to $108 per family. Of the 1,130 southern families, 611, or 54.1 per cent, reported the use of automobiles, for which families the expenditures for the car amounted to $127. Of the 1,439 families of the North Central states, 1,126 or 78.2 per cent, were using automobiles for household purposes. For these 1,126 families, the costs of the car attributable to household use averaged $119.

The small average expenditure for the use of horse and buggy for household purposes, $8.70 per family, is also interesting. This average varies widely for the three sections. Less than one-sixth of all families reported the use of horse and buggy. Of the 458 families reporting expenditures for this purpose, 50 were from New England states, 332 were from Southern states, and 76 were from North Central states.

In the class of a low level of land and farm values only two studies are presented; one in the hill country of New York State, taken in 1924, the other a more typical section of the low-value country, in the hills of southeastern Ohio, taken in 1927.

The average total values of all expenditures of 498 families in New York in 1924 was $1,077.60, in 300 families in Ohio, in 1927, $933. In the first study there were 10 families expending for their living a total below $600; 153 families, from $600 to $899; 189, from $900 to $1,199; 94 from $1,200 to $1,499; 35, from $1,500 to $1,799; 10, from $1,800 to $2,099; 7, $2,100 and over. In the second study, which is more typical of the low-value and low-income areas, there were 49 families spending less than $600; 102, spending from $600 to $899; 93, from $900 to $1,199; 56, spending $1,200 and over. This grouping of expenditures shows what is well known, that even in regions of prevailingly poor land and low incomes there are farm families that far exceed the mass in income and expenditure, just as in areas of prevailingly high land values and a high level of income there are families with low incomes and low expenditures for living. The items for housing, clothing, and advancement, in these regions of low land values and incomes, are outstandingly on a lower standard than in the region of high land values.

As a general commentary on farmers' standards of living, it is interesting to note the estimated number of farm-owned automobiles and to compare those figures with the estimated number of farms in the United States, in 1925, of 6,371,640. Estimates of the number of farm-owned automobiles, made by the *Farm Journal* of Philadelphia, are shown in the following figures:

Year	All motor vehicles	Passenger automobiles
1924	3,821,085	3,453,159
1925	4,332,482	3,853,526
1926	4,528,422	4,028,640
1927	5,007,124	4,408,470

Income and Purchasing Power.—Table 31[64] shows the average disposable income of the farmer derived from the farm business. The year 1919–20 was high; the two following years very low; a slight upward movement reached its peak in 1925–26, was followed by a decline again in 1926–27, and a recovery in 1927–28. House rent is not included in this figure of income.

TABLE 31.—AVERAGE DISPOSABLE INCOME OF THE FARMER DERIVED FROM FARM BUSINESS

Year	Income available for capital, labor, and management[a]	Interest allowance on net capital investment per farm[b]	Reward for labor and management
1919–20	$1,246	$329	$917
1920–21	684	287	397
1921–22	514	244	270
1922–23	682	242	440
1923–24	766	233	533
1924–25	854	230	624
1925–26	922	232	690
1926–27	862	226	636
1927–28	886	229	657

[a] Net income available for operators' capital, labor, and management calculated on the basis of the number of farmers interpolated between 6,448,000 in 1920 and 6,372,000 in 1925.

[b] Interest allowed on operators' net capital investment at 4.5 per cent.

The purchasing power of the farmer's product is another limiting factor in his standard of living, indeed competing in significance with income itself. The following figures, prepared by the United States Department of Agriculture,[65] give the relative purchasing power of the farmer's product, when the price he receives for his commodities is compared with the retail price of the commodities he buys, for the period 1919 to 1927. The base taken is the average prices for the period 1910–1914.

	1919	1920	1921	1922	1923	1924	1925	1926	1927
Relative purchasing power of farmer's product	102	99	75	81	88	87	92	87	85

VII. SUMMARY

Current impressions of the prevailing standards of living in the United States rest in the main on well-known index numbers of real earnings. All such measures point to a substantial rise in American standards in the past six years and probably to a considerable widening of the margin between American and European standards of material well-being as contrasted with the state of affairs before the war.

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[64] *Crops and Markets*, United States Department of Agriculture, July, 1927.

[65] *Ibid.*, July, 1928.

Such measures are defective because they do not account for all of the elements of family income, on the one hand, and also because they fail to make proper allowance for fundamental changes in the amount, quality, and character of the things people buy and use. It is neither possible to discover and measure all sources of family income nor to account completely for far reaching changes in consumption. Certain types of income can, however, be estimated and the outstanding changes in consumption described. For instance, the income represented by the free public services of education, charity, recreation, and health and sanitation increased from $859,336,000 in 1915 to $2,860,935,000 in 1926.

Surveys of the use of food, manufactured goods, automobiles, and housing reveal radical modifications in the habits of American consumption. New studies of family budgets will be necessary to correct erroneous impressions and to throw light on the sources and magnitude of prevailing family income.

Physiologically, per capita food requirements have declined, and are still tending to decline, especially in respect to quantities required for maintaining body heat and furnishing energy for work. With higher incomes per capita, higher standards of wholesomeness due to trade action and public inspection, a wider variety of foods available in all seasons and in all parts of the country, fuller knowledge of nutrition, and more widespread information on dietetics, there is reason to believe that the actual diets of to-day more nearly meet the physiological needs than has ever been true for the population as a whole.

Food standards have risen notably in respect to auxiliary satisfactions derived from food. The diet of to-day contains an unprecedented proportion of elements appealing to the appetite, the senses of sight, taste, and smell, and other aesthetic desires. It is strikingly diversified in the individual meal, from meal to meal, from day to day, from season to season. It is eaten with a substantial degree of assurance that the elements are wholesome. It permits of ready adjustment to individual idiosyncracies of need or taste, and to changes in the family income.

Present day food standards have also risen greatly in respect to economies in household expenditures of time and effort. To an increasing extent, food is purchased for the needs of the day. Less and less household labor is required in preparation, preservation, and storage.

The present diet is expensive in the sense that it entails a larger expenditure of purchasing power than is true in most other countries, or than was true in the United States in earlier years. Increasing congestion of population alone tends toward higher costs of distribution, which have been only partially offset by economies in production and marketing. Many of the gains already mentioned have entailed additional costs which are, for the most part, reflected in the prices of particular foods or food outlays as a whole. This is especially the case in respect to economies in household efforts, for small packages, prepared foods, prompt delivery, etc., entail heavier costs than bulk purchases of foods in an unprepared state, carried home by the consumer.

Considering, however, the character of the food consumed and the size of consumers' incomes, food costs can not be accounted heavy. By and large, a smaller proportion of the family income is required, under present conditions, to secure a safer better balanced. more varied, more appetizing diet than formerly.

There is still room for substantial improvement in food standards and substantial economies in food costs. While dietary improvements have been almost universal, large classes of the population can well make further advances in each of the three lines indicated. Avoidable malnutrition has not been eliminated. Much misinformation is widely circulated. Ideal standards of wholesomeness and honesty are by no means attained. Wastes of foodstuffs and of labor in connection with food are excessive from producer to consumer. Apart from the matter of suitable diets from the standpoint of nutrition, the food problems pressing for solution in America to-day are less those of the consumer, and more largely those of the farmer, the manufacturer, the wholesaler, and the retailer.

In the heterogeneous category of manufactured goods, the striking rise in output and, hence, in consumption has come in the manufacture of many mechanical articles of household equipment and of such new devices as the radio. The dramatic revolution, of course, is represented by the growth in the use of the automobile and by a current production of more than 4,000,000 cars a year.

Staple consumers' goods have not shown a great increase, as indicated by the slow growth of flour milling, slaughtering, cotton and woolen goods, and clothing. The industries manufacturing cigars, chewing and smoking tobacco, and snuff, have shown practically no growth, while the output of cigarettes has greatly expanded. In the textile and clothing group, including leather and its products, there has been no marked growth except for millinery, lace goods, and men's furnishings. Among textile materials there has been a great advance in the production of silks and rayon, knit goods, and carpets and rugs.

The volume of residential construction has increased more rapidly than population, and the quality of housing appears to show marked improvement, although very little material is available to show how large a part of our wage-earning population is still inadequately housed.

More than 40 per cent of the total farm population now living on low-value farms have not improved their standards of living in the period under review, and appear to have sustained such standards as they have by the use of a vast mortgage indebtedness. The 57.8 per cent of population living on high-value farms presumably have raised their standard since 1922.

CHAPTER II

INDUSTRY

PART 1.—CHANGES IN NEW AND OLD INDUSTRIES

By Dexter S Kimball

Every observer of American industry is impressed with its size and rate of growth. In a later chapter, Dr. Mills presents a table showing economic movements in the United States from 1922 to 1927. According to these figures, primary production has increased each year 2.5 per cent; production of manufactured goods, 4 per cent; and ton-miles of freight carried, 4 per cent.

We are producing more than two-fifths of the world's supply of coal, about seven-tenths of all the petroleum, practically all the natural gas, and more than one-third of the water power.

An outstanding fact has been the improvement in the efficiency of fuel consumption which has tended to check the growth in demand for coal, while other sources of energy were expanding, notably those of water power and of oil and gas. Bituminous and anthracite coal, which contributed 85 per cent of the world's total energy in 1913, furnished but 71 per cent in 1927, and but 64 per cent in the United States.

The growth of the electric light and power industry has also been phenomenal; about one-half of the total world capacity is in this country. The consumption of electric energy has been increasing at a rate about three and three-quarters times the increase in population. Production of electric current in 1927 was about 676 kilowatt-hours per inhabitant, as compared with 630 kilowatt-hours in 1926. The percentage of electrification of manufacturing industries was about twice as large in 1927 as in 1914.

In the production of iron and steel the United States has an annual output representing approximately half that of the entire world, the greater portion of which is consumed in this country. The production for 1927 was about 51 per cent greater than the average for the years 1910–1914.

Not only have most of our industries greatly increased in size, but there has also been a rapid increase in the size of industrial equipment and industrial structures. Buildings, engines, locomotives, steamships, and bridges have increased in size at a rapid rate in recent years. The new bridge over the Hudson River at One Hundred Seventy-first Street, New York, with a clear span of 3,500 feet, towers 625 feet high, and four supporting cables 36 inches in diameter, is without doubt the greatest and most difficult construction ever undertaken by man. And it should be remembered that the basic tools by means of which these great undertakings are built have increased proportionately in size and capacity.

Another fact of great importance for industry as a whole is the increase in the size and variety of consumer demands. These changes have helped to create and to quicken the constant flow of new materials and new products, some of them, like rayon, of startling economic significance, others like radio, appearing at present as mainly another addition to the crowded field of personal amusement. And a more searching examination of this flow of new things would uncover scientific research activities and applications of the results of research far in advance of anything existing a few years ago.

In addition to the more tangible and visible changes in size of industries and products, there has been a great advance in the last few years in what may be called the theoretical side of production. One of the most outstanding of these movements, and one that is intimately related to mass production, is standardization. The economic advantages of standardized products are now so fully recognized as to make the problem of standardization not only a national problem but also an international one. Our largest manufacturing plants produce largely standardized products and the lowest unit costs are found in connection with standardized production.

These varied phenomena have been much more in evidence since the World War than prior to that event. Yet the war developed no new basic productive processes. In this respect it differed from the Civil War which was instrumental in developing modern automatic machinery. The basic mechanical productive processes in use to-day are in general those in use before the World War. Chemical processes have come into more extended use in connection with the production of certain new materials, and processes like electric and oxyacetylene welding have appeared; but there have been no radical advances in the basic industrial processes.

The war, however, did focus attention upon the advantages of mass production. In the preparation of war material, many plants were narrowly specialized and many "single purpose" plants were organized. The Hog Island shipyard, with its many feeder plants, was in some respects the largest attempt at mass production that has ever been attempted, and the influence of this effort in calling attention to the advantage of mass production must have been considerable. The war also greatly expanded our industrial equipment, and the effort to keep this equipment in operation has been one influence in the vast production of recent years.

In any case there has been a decided movement toward the use of semiautomatic and automatic machinery wherever this is warranted, and in the larger industries some highly developed special machinery has resulted.

The last few years have witnessed a tremendous effort upon the part of factory managers to lower productive costs. This effort is twofold in character. First, close scrutiny has been given all methods and processes, and, second, an effort has been made to check avoidable wastes. The movement to check industrial wastes inaugurated by Herbert Hoover, when Secretary of Commerce, is of wide scope and great economic significance. American industry has been proverbially wasteful, and the gains that have already been made in some industries by waste elimination would indicate that we have here a hitherto neglected factor of great importance to industry.

The last ten years have also witnessed a fuller appreciation of industrial research and many interesting and important applications of the results of research. Many new materials have appeared and a number of new industrial processes. We are probably somewhat behind some European nations in this respect, but the realization of the importance of industrial research is growing rapidly.

One of the important influences has been the change in efficiency of rail transportation.[1] In 1927, goods were moved with the greatest rapidity in history, gross ton-miles per train-hour increasing 47.5 per cent as compared with 1920, and ton-miles of revenue freight carried exceeding by 42 per cent the performance of 1913. Between 1901 and 1913, the ton mileage of the carriers had practically doubled. Employee productivity showed an important increase, the index of traffic units handled per employee, based on 1913, being 134.4 in 1927.

An important element in the increase in output has been the rapid abandonment of inefficient plants. In a recent survey of the merchant blast furnace industry, it is reported that "of the 37 plants furnishing data for the prewar years 1911–1914, 15 were both hand filled and sand cast, while only 8 were mechanically filled and machine cast. But in 1926, out of 49 plants furnishing data, only 3 were both hand filled and sand cast, while 34 were both mechanically filled and machine cast."[2] The significance of the record lies in the fact that in 1911–1914, the modern methods were known but were applied in but three plants. In 1926, nearly three-fourths had adopted the improved machinery.

Until comparatively recent times, the problem of industry was to produce in sufficient quantity to supply the demand. To-day the problem of industry is largely that of disposing of its products. If manufacturing industry should devote all of its energies to the production of *necessities* alone, it would be difficult to dispose of the output intelligently. The problem of industrial production has been temporarily solved, and as a consequence we have passed from a "sellers' market" to a "buyers' market."

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[1] See Chap. IV, Transportation, Part 1, p. 285.

[2] United States Bureau of Labor Statistics, "Productivity of Labor in Merchant Blast Furnaces." *Bulletin* No. 474. Washington, 1928.

These rapid glances at industrial changes suggest the significance of shifts in consumer demands and the importance of technical improvements in recent years. Without mass consumption there could not be mass production.

Mass production necessitates mass financing and mass management. Large enterprises are comparatively more difficult to organize and manage than small ones and, as a result, a great deal of thought and experiment have been expended in recent years upon the problems of management. It is significant that these problems are now sufficiently crystallized to form the nucleus of instruction in colleges of high standing. The growth in the size of industrial plants, and the consequent advantage that may be taken of the principles of standardized quantity production, will depend to no small degree upon our ability to finance and manage large plants upon sound economic principles.

Out of these changes has developed the astonishing increase in productivity which is discussed in Part 2 of this chapter. But it is obvious that not all industry is prosperous nor all industrial leaders progressive. Anyone well acquainted with industry knows that there is much inefficiency in both management and production. The fact remains that the field of industry as a whole has made marked advances during the last decade, and the productivity per worker in most industries has been advanced markedly. Never before has the human race made such progress in solving the problem of production. If poverty and industrial distress still exist, it is because of our inability to keep our industrial machinery in operation and to distribute equitably the resulting products. It is not sufficient to be able to produce abundantly; we must also be able to distribute intelligently.

In recent years the developments in new productive methods have been so startling as to force themselves upon the attention of all men. But these developments are the result of changes which began many years ago, and which have gathered such momentum during the last few decades as to raise serious questions as to their present influences and probable future effects. For the purpose of this discussion these changes may be listed as follows:

(a) Disappearance of old industries and callings.
(b) Changes in character of old industries.
(c) Growth in size of old industries without change in character.
(d) Development and growth of new industries and callings.[3]

[3] A new industry is one which is producing a new product, such as rayon, or which involves a new process or technique, such as electric welding. A new trade or calling

It would be superfluous to recount the advent of the Industrial Revolution with its constantly increasing tendency to undermine and eliminate handicraft production. It should be noted, however, that the growth of modern factory methods[4] in the United States was comparatively slow during the nineteenth century, handicraft production either by individuals or in handicraft factories predominating until about 1850, and production by these methods was quite common as late as fifty years ago in some callings.

By the year 1900 the value of manufactured goods exceeded that of agricultural products, and therefore the census of 1900 may be taken as a datum from which to measure industrial changes. Furthermore, this census contains certain comments upon the new industrial methods, then just assuming great importance, which are most illuminating in view of recent developments and which will be alluded to later on. The biennial census of manufactures for 1925 is the latest corresponding document, and since no marked changes have occurred since then, comparisons between these two statistical reports are enlightening.[5]

Disappearance of Old Industries and Callings.—A comparison of the industries listed in the census of 1900 with the corresponding list given in the biennial census of manufactures for 1925 shows that few industries have actually disappeared. Nearly all of those listed in 1900 appear also in the list of 1925. There are some interesting exceptions. Thus, blacksmithing and wheelwrighting, which in 1900 employed over 5,800 men, is not mentioned in the 1925 list. Distilled liquor is, of course, not included in the 1925 list but appears as ethyl alcohol, and there are a few smaller industries, such as lock and gun smithing and watch and clock repairing, which are not considered important enough for the 1925 list. But, in the main, the list of industries cited in 1900 is included in some form in 1925.

Some of the industries listed in 1900 and 1925 have declined greatly. Thus, in 1900 there were 7,632 establishments employing 62,540 workers

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is one which requires a new body of knowledge or a new specialized skill on the part of the worker. Thus electric welding and chauffering may be considered as new callings, whereas there are probably no new trades involved in the production of radio apparatus.

[4] The term "modern factory methods" is used here to define production by the use of "transfer of skill" and extended division of labor. The most important machine tools upon which modern manufacturing depends are the turret lathe, the automatic screw machine, and the milling machine. These appeared in America about the middle of the nineteenth century and gave a tremendous stimulus to manufacturing. Grinding machinery, which has become almost as important as these machines, was a later development.

[5] It should be remembered that the population of the United States increased from 74,607,225 in 1890 to over 113,493,000 in 1925. Also, all such statistics as are expressed in dollars must be interpreted with reference to the relative value of money at the two dates discussed.

making carriages and wagons. In 1925 there were only 152 establishments employing 4,833 persons in this industry. As might be expected, saddlery and harness-making show a corresponding decrease [6]

The development of factory methods during the period under review has practically eliminated some handicraft callings. Thus the 1900 census distinguished between custom or hand-made shoes and the factory-made product. The census of 1925 makes no such distinction, practically the entire product being factory-made. In a similar way, other callings, such as custom-tailoring, village blacksmithing, cooperage, and cabinet making, have succumbed almost, if not entirely, to factory processes. There are, of course, survivals of some of these handicraft callings to-day, but their total output is negligible compared to the factory-made articles. However, the basic building trades, such as carpentry and bricklaying, have survived, though they have been supplemented by many other building trades. The basic machine crafts, such as machinist, boiler maker, foundryman, and pattern maker, are still important and to a certain degree unchanged, though their places in industry have been changed and their tools greatly improved. These callings, as will be seen from a later discussion, must necessarily survive since upon them rests the entire industrial fabric. Comparatively few industries, as such, have disappeared, though many of them have greatly changed.

Changes in Character of Old Industries.—While many industries which are listed in the 1900 census appear under the same name in 1925, it is well known that they have been greatly changed as to methods and process. In some instances they bear little relation to the industries of the same name of 50 years ago. As an illustration, consider the men's clothing industry. The census of 1900 lists 28,014 establishments employing 191,043 persons with an output valued at over $415,000,000. The 1925 census lists only 4,000 establishments employing only 174,332 persons but with an output valued at over one billion dollars. Again, in 1900, there were 23,560 custom shoemaking establishments employing 9,689 persons as compared to 1,900 factories, so-called, employing 143,000 persons. In 1925, there were only 1,460 establishments, but they employed 206,992 persons and their output was valued at $925,383,422. This industry has been almost completely changed from handicraft to machine production with corresponding changes in the workers involved. Practically all of the older industries which have survived have been affected more or less in a similar manner, either by the introduction of new processes or new methods of production.

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[6] It has been suggested that an inventory of the idle manufacturing plants might be something of an index to industrial change. The writer is skeptical as to the value of such a survey, except as it would show that industry has been and is now in a state of flux. Idle plants should not be confused with the disappearance of trades and industries. Plants become idle for a variety of reasons, such as exhaustion of resources, bad management, supercession of other products or processes, and migration of industry as a whole to other localities. American industry presents, and will probably present for some time to come, just such a picture. Some reasons for this phase of industry are to be found in certain basic changes in our manufacturing methods which are discussed in a succeeding section and with which this report is primarily concerned. As a corroboration of this statement, the census of 1900 gives a detailed list of the idle plants at that date. They numbered 3,864 with a total capitalization of about one million dollars and included 188 different industries. No doubt a similar survey at any time will show similar results. Further discussion of obsolescence is found in Chap. III, Construction, p 226; Chap. IV, Transportation. Part 1, p. 263; Chap. V, Marketing, p. 330.

Growth in Size of Industries without Change in Character.—Many of the industrial plants of the old type have greatly increased in size for three reasons. First, the size of the product needed has greatly increased. Engines, locomotives, ships, bridges, for example, have all increased enormously in recent years, necessitating corresponding increase in the size of the physical equipment of the producing plants. Or the size of the productive units has been increased so as to secure greater economy of operation. A blast furnace of 500-ton capacity is much more economical than one of 100 tons; and it requires no more men to operate a 4,000 horse power locomotive than it does to operate one of 400 horse power. Many old industrial plants, however, have expanded in size with no marked changes in product, solely to secure the benefits of quantity production in the matter of productive costs.

Development and Growth of New Industries and Callings.—By far the most interesting and important development is the rise of new industries and new callings. For it is in the character of the productive methods by which new industries have been built that we must look for the answer to some of our industrial problems. Some of these new industries, like the automobile and the airplane, are built upon and are extensions of old trades and callings. Others, like the electrical industries, while resting primarily upon old trades and callings, have developed many ramifications and adaptations of these old trades into what are practically new callings. Others again, while having their genesis in chemical processes, must necessarily be constructed through the use of the old mechanic arts. And all of them have been affected by modern productive methods. The magnitude of some of these new industries is impressive. Thus the automotive industry, not mentioned in the 1900 census, is credited in the 1925 census with employing over 400,000 men, with an output valued at over $4,000,000,000. Rayon, mentioned specifically for the first time in the census of 1925, employed 19,128 workers, and the product of radio manufacture, an enterprise only a few years old, was valued in 1927 at about $191,000,000. The value of the telephone and telegraph apparatus produced in 1927 was estimated at over $119,200,000. The chemical industry, a new growth, employed 38,075 workers, with an output valued at $6,438,027,000.

A new industry that produces a product which tends to supplant the product of an old industry does not necessarily eliminate the old industry, even though the new product may be superior in many ways. The new product may find an enlarged field, leaving the old product to do the same and to hold part of its old field. The telephone did not supplant the telegraph nor does the radio supplant either of them. The electric light did not eliminate gas any more than oil has entirely supplanted coal, and the motor truck and auto-bus seem to be progressing toward co-ordination with older methods of transportation. By similar procedure, rayon is making its own place, and probably will not eliminate cotton and linen. We shall no doubt witness the development of many new synthetic products to supply the lack of natural animal and vegetable products as the supply of these diminish, and we may expect to see many new products to satisfy new or old needs.

Basic Principles.—The oldest and most important economic principles of production are division of labor and transfer of skill. Both have been used by men from time immemorial, but in recent times they have assumed commanding importance. The first is so well known and understood as to need little or no comment, except to elucidate its close connection with the second principle. Transfer of skill and its effects are not so well understood. The principle is inherent in the use of tools of every kind. Whenever the tool is improved, less skill is required upon the part of the operator to produce a given result. The true significance of the Industrial Revolution was that it carried transfer of skill to such a degree as to make the worker an adjunct to the tool, whereas formerly the tool was an adjunct to the skill of the worker. Modern industry differs from handicraft primarily in this particular. Yet, strictly speaking, there is no such thing as an automatic machine since all require human attention, and the terms automatic and semiautomatic are comparative only.[7]

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[7] It should be noted in passing that the development of all modern machinery rests upon the use of so-called machine tools. These basic tools are the lathe, the planing, drilling, milling, and grinding machines and their variations and deviations. These basic tools have been highly developed both as to size and accuracy, and fill a most important rôle in modern production. With such basic callings as foundry work, pattern making, and rolling mills, all other industrial machinery is produced. And what is equally important, they can be made to reproduce themselves. The growth in the size of these basic implements should also be noted. The first lathe, built about 1800, could be carried by one man. Large modern lathes can machine a cylinder 10 feet in diameter, 40 feet long, and the largest boring mill in America can machine work up to 60 feet in diameter. More important still, much larger tools can be constructed, so that, if other conditions warrant it, the size of industrial products can be greatly increased. The sizes that locomotives, bridges, and steamships may attain in the future will probably be governed by economic considerations, and not by the size of our basic tools.

These new methods naturally tend to extend the principle of division of labor. Specializing an industrial plant automatically specializes the workers. And even in industries which are not highly specialized, division of labor is accomplished by separating the operations to be performed and assigning a single operation, or a limited number of them, to each worker. As a corollary, when the operations necessary to produce a product are thus separated, it is easier to design a special machine for each operation. Transfer of skill and division of labor are mutually supplementary.

It should be remembered, also, that just as there may be division of manual labor so there may be division of mental labor. Thus the engineering and designing function was long ago separated from the work of actual production. The development and extension of this principle, as applied to modern management, will be discussed elsewhere in this survey since it is the most important principle in so-called scientific management. The importance of the principle in this particular discussion rests upon the fact that labor-saving management is similar in its effect upon the worker, in many ways, to the results produced by the application of transfer of skill. The growth of knowledge, both scientific and nonscientific, the discovery of new methods and processes, and the invention of new products, all tend to extend the use of division of labor and transfer of skill.

The Effect upon the Economic Status of the Worker.—One of the most significant effects of the extension of transfer of skill has been the increase in the capital investment per worker. The biennial census for 1925 gives the investment per worker in 1849 as about $560. By 1919 this ratio had risen steadily to nearly $5,000, the yearly increase in capital being always greater in proportion than that of the workers employed. In addition to the limitations set by the increasing cost of the tools of production, the use of power is increasing. From 1914 to 1925, the horsepower per industrial worker increased from 3.3 to 4.3. It should be noted also that, while the agricultural worker still owns his implements to a large degree, he no longer makes them himself. Analogous to the growing separation of the industrial worker from ownership of the tools of production, the separation of agriculture from the mechanic arts, that started with the Industrial Revolution, is becoming complete.

Effect upon Unit Costs.—It is an established principle that unit costs can be reduced by the use of transfer of skill and division of labor. The gain through the use of division of labor follows mainly from the increased skill and speed which accrues to the operator through repetitive effort. But the gain from the use of improved machinery rests upon different economic grounds. The principle holds true, that unit costs can be decreased as the quantity to be produced is increased, and, therefore, where the quantities are very large, great expenditures can be made for improved machinery. Possible limitations to this principle will be discussed later.

The truth of these statements is borne out fully by the census reports. The increase in capital investment per worker has already been noted. The increase in the value of output per worker is equally significant. In 1900, this value was about $1,600, while in 1919 (the last census available) this ratio had risen to about $7,500. Making allowance for the changed value of the dollar, this is a great gain in value produced per worker, and it can be attributed only to improved methods of production. The ratio of the value of products to capital investment in 1890 was 1.04. In 1919 this ratio was 1.4. But since the value of the dollar at present is much less than in 1919, the true ratio is probably less. In all probability we may look for a diminution of output per dollar of invested capital, if for no other reason than because of the operation of the law of diminishing returns.

It will be clear, therefore, that the degree to which use may be made of transfer of skill and division of labor depends upon the quantity to be made. The greater the quantity, the more complete and costly may be the tools. But the more highly developed the tools, the cheaper becomes the product, and a decrease in the cost of the product stimulates the demand for it. This in turn increases the number that can be made.

Standardization, Simplification, and Interchangeability.—One of the most important sources of industrial waste is the variety in which many articles are manufactured. As has been explained, the unit cost of any article can, in general, be decreased as the quantity to be produced is increased. For a given total production of any article, the greater variety in which it is produced, the smaller must be the number of each size or model, and consequently the higher must be the unit cost. This principle is well known by most manufacturers, but there are often other considerations which lead them to produce a given line of goods in such a variety of patterns and sizes as greatly to reduce, if not entirely eliminate profits.

On the side of the manufacturer is the natural desire to have something different from his competitors in order to put forward a real or imaginary superiority in his product. There is, therefore, a natural tendency to bring out new and "improved" models, while possibly continuing to manufacture the old lines. There is also the desire and need to produce a line of goods to satisfy varying purchasing power of customers. Thus phonographs and automobiles are produced in a wide range of qualities and prices. This tendency upon the part of the manufacturer has been greatly increased by the attitude of the modern aggressive salesman who, in order to combat the resistance of a purchasers' market, demands new and more attractive designs.

On the part of the purchasing public there tends to be a demand for products having individuality. Many people wish to have writing paper, pocket knives, or automobiles, unlike their neighbors'. In wearing apparel and other personal accessories, the demand for changes in fashion is pressed both by the purchaser and the manufacturer. As an extreme illustration of this tendency, colored bed-linen has lately been put upon the market. These desires upon the part of both producer and consumer have brought about such a complexity as to give rise to a well-defined movement not only to check this tendency where possible, but also to eliminate one of the existing wastes due to it. The movement is characterized broadly as "standardization," but a highly important part of the movement which has been developed by the Department of Commerce has been aptly called "Simplification."[8]

The United States Bureau of Standards is the source of and sponsor for all basic scientific standards, while the American Engineering Standards Committee, representing 33 American engineering and scientific societies, is sponsor for the standardization of engineering standards, safety codes, and similar standardizing literature. These and other similar movements have greatly aided and influenced standardization, in a general way, in standardizing nationally many machine elements such as bolts, nuts, and gear teeth. The movement as a whole is far from being well-organized, and much remains to be done before national standardization can be said to be effective. The problem is complex and difficult, and it may be that, at the most, in many lines of production we shall obtain only partial success.

Standardization in a manufacturing sense is the reduction of any line of product to fixed types, sizes, and characteristics. No doubt great savings can be made by extending the principle, even though full standardization may be neither necessary nor desirable.

The work of simplification is stimulated by the Division of Simplified Practice of the Department of Commerce. The general method of attacking such a problem is to study it thoroughly and then, calling together representatives of manufacturers, distributors, and consumers of the article under discussion, to seek their agreement to the elimination of certain types and sizes. In this manner, 62 out of 66 varieties and sizes of paving brick were eliminated, the sizes of building lumber were greatly reduced, and many similar reductions have been made in other lines of product. There can be no doubt as to the economic significance of the adoption of a national policy of simplification. Vast savings can be made by simple reductions in types and sizes in many lines of products, with no sacrifice of appearance or utility.[9]

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[8] It is not necessary to discuss the broad general aspects of international and national standardization as pertaining to basic scientific standards. We are concerned here only with those aspects of the movement which affect actual production in this country, though such standardization may be of great importance nationally, to an industry as a whole, or to a single plant.

A basic principle in quantity production is that every element of the product shall be, as nearly as possible, exactly like every other similar element or part. Every manufactured product is, in general, the work of many men, and is built up on the assembly floor (or corresponding place) from parts made by workmen who may never see the finished product. A modern factory producing automobiles, sewing machines, clocks, or shoes, is like a river, the various elements *flowing* like tributaries from the several departments and merging smoothly into the stream of finished product which comes from the assembly floor. The success of such methods depends on every element being exactly right or "standard," as such requirements are called.

The interchangeable system of manufacturing is not confined to any *quality* of product. It is applied to the production of the cheapest and also to the most expensive article, where any quantity is produced. The degree of refinement or limits of accuracy may vary, but the principle is the same. The mechanical limits in the best work are remarkable. Our best standard dimensional gauges, as actually used in factories, are accurate to the three-millionths of an inch. The component parts of apparatus, such as typewriters and automobiles, are made to such accurate and close dimensions that no fitting of individual parts is required or permitted on the assembly floor. When it is considered that these results are often produced by semiskilled workers, the refinement of transfer of skill, as illustrated in modern tools, is astonishing. The economic results are no less astonishing. Without doubt, the most remarkable and most perfect product in many ways that man has produced is the automobile. Without doubt, also, the greatest value per man-hour of labor ever offered upon the market is to be found in some of these cars of moderate price. The extension of the principles of standardization to the human element in production is a most important and growing field of activity.

Time-Saving Management.—Modern machinery involving transfer of skill is usually spoken of as *labor-saving machinery;* it is also *time-saving.* The normal work of operating a modern semiautomatic machine may be much greater than to perform the same operation upon a standard machine. The output of the semiautomatic is, however, much greater *per unit of time*, hence the labor *per unit of product* is less. The full automatic machine, therefore, is both a time-saving and a labor-saving machine, for the parallel development of transfer of skill and the application of power have both been applied to the construction of the machine. Modern management, commonly called scientific management or industrial engineering, is concerned with the saving of time as well as labor.

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[9] For results of simplification, see pp. 116 to 119.

The net influences upon the worker are identical with those that follow transfer of skill.

Power, Transportation, Communication.—A discussion of industrial change of necessity involves a consideration of the growth of the use of power, the development of transportation facilities, and of the art of communicating intelligence and information. These will be discussed in detail by others elsewhere in this survey, but it is necessary to mention here their net effect upon the growth and change in industrial plants.

The increased use of power is most important and significant. Data are lacking in the census of 1900 as to the total horse power then in use, but the census of 1925 shows an increase in manufacturing horse power from 22,264,343 to 35,772,628, from 1914 to 1925. The total prime mover capacity in the United States to-day is probably in the neighborhood of 800,000,000 horse power. It is estimated that this is about four times as great as that of Great Britain or Germany, and ten times as great as that of France. More significant still, the per capita wealth in the United States bears the same ratio to the per capita wealth in Great Britain that the total per capita horse power here does to the per capita horse power there. Our productive capacity, therefore, rests largely upon the fact that our productive machinery is not only *time saving* in character but *labor saving* also.

The growth in the size of central station machinery should be noted. The first large turbo-generator built by the General Electric Co. about 1900 was of 5,000-kilowatt capacity. To-day, single units of 50,000-kilowatt are common, combined units of 100,000 not unusual, and one of 208,000-kilowatt capacity is under construction. The new State Line Power House of the Chicago Edison Co. will have a final capacity of 1,000,000 kilowatts, and there is no apparent diminution to the growth of such plants, either as to size or number. A survey of our public utilities in the *Blakemore Analytic Reports,* dated December 20, 1926, gives the total horse power of prime movers in this industry as 3,000,000 in 1902; 12,000,000 in 1912; 24,000,000 in 1922, and a prospective 30,000,000 in 1930. As an index of the increased use of power, these figures are most impressive.

The art of communication, as developed in our postal service, telegraph, telephone, and radio systems, has had a tremendous accelerating influence upon all industry. This influence cannot be quantitatively measured, but its effect upon modern life is profound. Not only has the art of communication developed great new industries for the manufacture of its own products, but it has also greatly aided in the transformation of other industries. In connection with transportation, it has affected the location and the migration of industry. It is also greatly modifying and reducing the amounts of raw materials that are carried in stores by manufacturing plants. Quickness of communication and rapid transit, as developed by modern freight service, have brought the entire chain of manufacturing very much closer together. The development of means of rapid communication, like the development of tools of production and the development of sources of power, is one of man's ancient problems which, in the period under review, has advanced remarkably toward solution.

Modern industry, then, develops in two ways, first by the growth and expansion of old industries, and second by the development of entirely new industries, producing new products. The old industries tend constantly to change in character internally, through the use of improved and new methods and further division of labor. They tend to partake less of handicraft and to employ more transfer of skill. As a consequence, the output per man constantly increases and this, coupled with the changes due to the introduction of time-saving apparatus, tends to unemployment without reference to good or bad times. Some of the workers thus displaced find employment in other old industries and many are absorbed by the growth of new industries. The extent of this unemployment, so far as skilled workers is concerned, is hard to gauge, and data are lacking. But the phenomenon of what in current discussion is called technological unemployment is nothing new. It is as old as the present industrial system and it is inherent in this system.

The census of 1900 comments upon this type of unemployment: "A factor that has had a real tendency to lower the actual earnings of the wage earner in many industries is the displacement of the skilled operator by machinery which permits the substitution of a comparatively unskilled machine hand. This tendency is noticeable in many lines of industry. Its effects are twofold: To reduce the number of employees producing the same, or an increased quantity of product, and hence to lower the total wages of the group; and to reduce the average rate of wages because of the lower degree of skill required. The effect of the introduction and improvement of machinery upon the condition of the skilled artisan is an economic question of the greatest importance." The census report gives statistics supporting this view, and cites, as an instance, the case of the boot and shoe industry where "an increase of 18.3 per cent in value of products resulted from an increase of 22.2 per cent in value of machinery and tools used, with only 6.9 per cent increase in number of wage earners and an apparent decrease of 2.5 per cent in wages paid." This is a true picture of the effect of modern methods as far as it goes. It does not, however, give a most important item, namely, the change in the unit cost of the product. Nor does it take into account the growth of the shoe-machinery industry.

The recorded experience of the period from 1900 to 1925 does not bear out the fears expressed in the census of 1900. That census lists the number of workers in the shoemaking industry, both handicraft and factory, as 153,620, and gives their earnings as $63,304,344, or about $415 per person. In 1914, the number employed was 191,555, with earnings of $105,695,404, or about $522 each. In 1925, there were 206,992 workers, with earnings of $225,787,981, or about $1,090 per person. The purchasing power of the dollar of 1925 was about 66 per cent of that of 1913 and 53 per cent of that of 1900, but even with these allowances there has been a gain in real wages since these dates. Furthermore, in 1900 there were 4,649 children under 16 years of age employed in this industry, with earnings of $822,648, or about $177 per child. No such conditions are tolerated to-day in progressive states.

Again, in the printing industry the census of 1900 lists the number of workers as 162,992 with earnings of $84,249,963, or about $517 per person. The census of 1925 gives 251,276 persons thus employed, with earnings of $438,832,974, or $1,746 per person. Here again, allowing for the difference in the dollar, there has been a decided gain. Furthermore, such statistics do not take into account the increased employment due to the production of machinery for these industries. In 1925 the value of the printing machinery produced in the United States was $69,216,683, and the corresponding value of shoemaking machinery was $11,769,137, and each of these industries have ramifications that would be difficult to follow. An analysis of other industries over any period of time would no doubt show similar tendencies.

The expansion of old industries, however, is not sufficiently rapid, apparently, to absorb the rising generations, but up to the present time the increase over and above those absorbed by the old callings has been taken up by the new industries. These new mass production industries deserve more than passing consideration. Most of them, such as those that build automobiles, cash registers, and telephones, have not developed for the most part on a basis of handicraft skill, but have been constructed from the beginning as mass production enterprises. A modern mass production factory is not an accretionary affair, but it is designed in the beginning for full use of transfer of skill and division of labor. The number of skilled and experienced workers may be small as compared to the actual semiskilled producers and those who conduct the highly divided office functions. The employees of such an enterprise may not be recruited to any large degree from older industries, but from young men and women who have had little or no experience in the particular line of work to be produced. And because of modern methods they can soon take part in the production of such highly refined products as telephones and radios, which under older methods would require a high degree of skill and experience.

Summary.—From the foregoing it will be clear that American industry is in a state of flux, with changes occurring not only in the character and personnel of many industries, but also in their economic status. Some of these changes or tendencies are as follows:

1. There is a continuing tendency for the handicrafts to disappear in favor of factory processes, except in such industries as the building trades. Even in these callings, however, new methods such as electric welding are making themselves felt.

2. In all factory work there is a tendency to extend transfer of skill and division of labor not only in actual production but also in the managerial side which is becoming mechanized at a rapid rate. This tends again to break up the trades and callings into small functions which can be performed by people of less skill and training.

3. A distinction should be made between the disappearance of industries and their *transformation* by the introduction of modern methods. The census reports show that few industries have disappeared, the list given in 1900 appearing for the most part in the census list of to-day These industries, however, have in many cases been greatly changed internally by modern methods. Thus, shoemaking and clothing manufacture still bear the same name, but they are really, in most respects, new industries.

Many industries that survive in the same form externally, such as shipbuilding, locomotive building, and the machine trades in general, have grown in size and capacity. The product is often much larger; the equipment as a consequence much larger. No limit as yet has been reached, apparently, to the size of product. We expect to see larger locomotives, bridges, ships, buildings, and tunnels.

4. On the other hand, the last quarter of a century has seen a great increase in new industries, the result of scientific discovery and of mechanical development. These are well illustrated by the telephone, radio, automobile, rayon, refrigerators, electric welding, chemical and electrical industries. These are of more than passing importance, for many of them have grown into great enterprises employing many thousands of men and producing new products in vast quantities that have found ready markets. These new enterprises really constitute the most remarkable and most important phase of modern industry, and their true economic significance probably holds the clue to our industrial and economic future.

5. There is an increasing tendency, therefore, toward mass production, particularly in the case of these new products, with the object of reducing the price and extending the market. This principle is being applied not only to articles of real worth, but also to many products of doubtful economic value. This tendency naturally increases the size of manufacturing plants, and this is reflected in the constant increase in the relative number of plants that are owned corporately.

6. Modern productive methods tend to be more highly functionalized under four groupings, namely, management, design, toolmaking, and actual productive operation. The design of the product and also of the

general methods of production and plant layout has become a calling of its own, almost entirely separated from the actual production itself. In a similar manner, the actual tools of production are provided by machine tool builders and builders of special machinery. Lastly, the actual production in large quantity-production plants is performed largely by the "operator" type of worker, that is, a person who by special adaptation has been taught to operate a tool or process in which there is a high degree of transfer of skill. Automobiles, typewriters, shoes, sewing machines, etc., are not produced by skilled mechanics but by semiskilled operators to whom the field of manufacturing has been "extended" by these new methods.

7. Paralleling these developments is the rapid growth of power producing plants, driven by steam, oil, or water, and greatly increasing the output per person, with modern transportation facilities and improved means of communicating intelligence speeding up the entire industrial mechanism. Necessarily this has made industry more sensitive and more mobile. These influences tend to change and level up the economic advantages of different sections of the country and to develop new industrial centers.

8. It should be noted that industrial development is becoming less and less a matter of accident so far as basic scientific data are concerned. A few years ago new ideas came into industry largely as the result of the work of independent inventors experimenting empirically, or as the result of work in university laboratories. To-day the idea of organized industrial research is thoroughly established both in university laboratories and in many industrial enterprises.

9. Finally, experience shows that the shifting of labor, called technological unemployment, is a constant accompaniment of progress in modern industry. Like other wastes of our industrial system, it calls for examination. In all probability, our hope for a higher economic level rests as much upon increased efficiency and avoidance of waste as upon new processes and inventions.

PART 2.—TECHNICAL CHANGES IN MANUFACTURING INDUSTRIES

BY L. P. ALFORD

I. NATIONAL CHANGES IN TECHNICAL PRODUCTION FACTORS

The key to an understanding of recent technical changes in manufacturing is the increase in productivity, or the increase in output per worker. Therefore, the other factors will be studied in relation to the changes in productivity. Those which are capable of quantitative study on a national basis are:

1. Physical volume of production.
2. Number of wage earners.
3. Wages paid.
4. Cost of materials for manufacture.
5. Prime cost.
6. Primary power.
7. Value of manufacturing buildings.
8. Value of manufacturing machinery.
9. Hours per week.
10. Weekly wage rate.

In addition, two derived unit factors are discussed, as well as individual productivity, making three in all.

1. Productivity per wage earner.
2. Unit prime cost.
3. Primary power per wage earner.

Table 1 gives index numbers of those factors for American manufacturing industry as a whole, for the period 1899 to the date of latest available statistics.[1]

These data have been plotted in various relationships on Charts 1 to 7, inclusive, to visualize the changes that have taken place. Semi-logarithmic (or ratio) co-ordinates have been used.

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[1] Data included in this table were secured from the following sources: *United States Census of Manufactures*, 1925; "The Economic Significance of the Increased Efficiency of American Industry," by Woodlief Thomas, *American Economic Review*, Supplement, March, 1928; "A Theory of Production," by Charles W. Cobb and Paul H. Douglas, *American Economic Review*, Supplement, March, 1928; *Wages in the United States, 1914–1926*, published by the National Industrial Conference Board.

TABLE 1.—INDEX NUMBERS FOR 13 PRODUCTION FACTORS FOR PERIOD 1899 TO DATE OF LATEST AVAILABLE STATISTICS

(1899 base year, except for columns 10 and 11, for which 1914 is base year)

1	2	3	4	5	6	7	8	9	10	11	12	13	14
Year	Physical production	Number of wage earners	Wages paid	Cost of materials for manufacture	Prime cost	Primary power	Value of manufacturing buildings	Value of manufacturing machinery	Hours per week	Weekly wage rate	Productivity per wage earner	Unit prime cost	Primary power per wage earner
1899[a]	100	100	100	100	100	100	100	100	..	.	100	100	100
1904[a]	122	117	130	129	130	134	139	138	..		104	106	115
1909[a]	159	145	171	183	181	185	187	187	.		110	114	132
1914[a]	169	156	203	215	212	222	221	223	100	100	108	125	151
1918	220	210	...		...	. .	225	230	.	.	. .	..	. .
1919[a]	214	204	522	563	553	292	..	.		.	104	258	152
1920	222	205		.	.	.	. .	.	95	234		.	
1921[a]	170	158	410	383	388	. .	. .	.	88	188	107	228	.
1922	223	173	.	.	..	. .	285	296	96	192	.	.	...
1923[a]	261	197	550	524	528	330	. .	.	96	212	132	202	176
1924	246	188	. .		. .	.	.	.	91	210		..	
1925[a]	275	188	536	547	545	356	..	.	94	214	147	198	199
1926	285	189	. .	..		...	.	...	94	216	. .		
1927	280	187	...	...	. .		.	...	..	.	[b]151–5	...	

[a] Census years. [b] Estimated by Woodlief Thomas.

Sources: Columns 2, 3, 7, and 12 from "The Economic Significance of the Increased Efficiency of American Industry," by Woodlief Thomas, *American Economic Review*, Supplement, March, 1928. Columns 4 and 5 from *United States Census of Manufactures*, 1925 Columns 8 and 9 from "A Theory of Production," by Charles W. Cobb and Paul H. Douglas, *American Economic Review*, Supplement, March, 1928. Columns 10 and 11 from *Wages in the United States, 1914–1926*, National Industrial Conference Board.

Chart 1 shows unit productivity and unit prime cost. The first has increased from 1919 on; the second has decreased steadily from that same year.

CHART 1—RELATIONSHIP OF PRODUCTIVITY PER WAGE EARNER AND UNIT PRIME COST

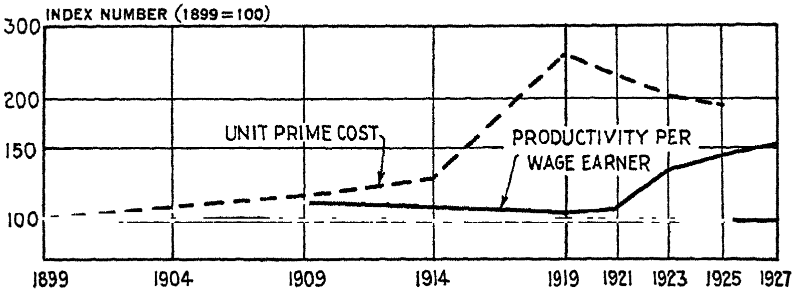

Chart 2 has three curves—physical volume of production, number of wage earners, and productivity per wage earner. The third, point by point, plots as index numbers the quotient of the first divided by the second.

CHART 2.—RELATIONSHIP OF PHYSICAL VOLUME OF PRODUCTION, NUMBER OF WAGE EARNERS, AND PRODUCTIVITY PER WAGE EARNER

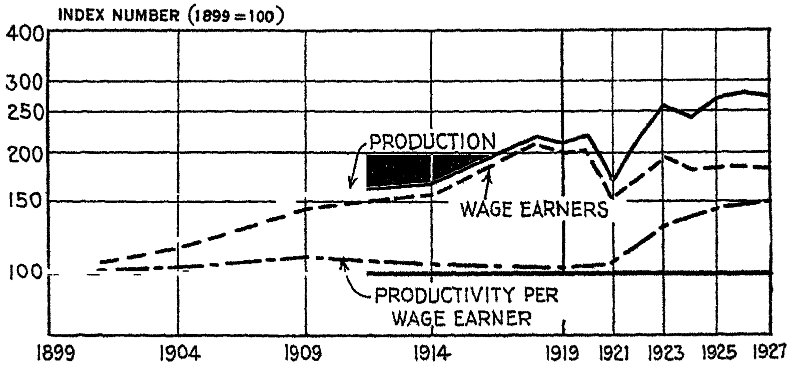

Chart 3 shows the cost of materials, wages paid, and physical volume of production. The first two are the cost elements which added together give prime cost.

Chart 4 also has three curves—prime cost, physical volume of production, and unit prime cost. The relationship between them is that unit prime cost is the quotient of prime cost divided by production.

CHART 3.—RELATIONSHIP OF COST OF MATERIALS, WAGES PAID, AND PHYSICAL VOLUME OF PRODUCTION

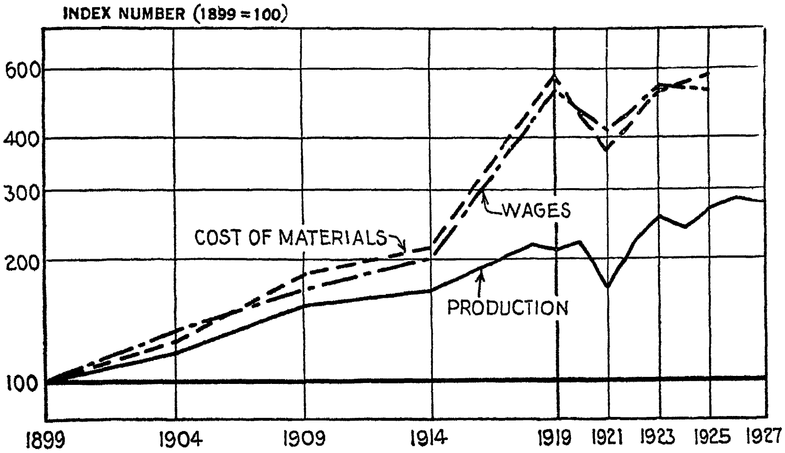

CHART 4.—RELATIONSHIP OF PRIME COST, PHYSICAL VOLUME OF PRODUCTION, AND UNIT PRIME COST

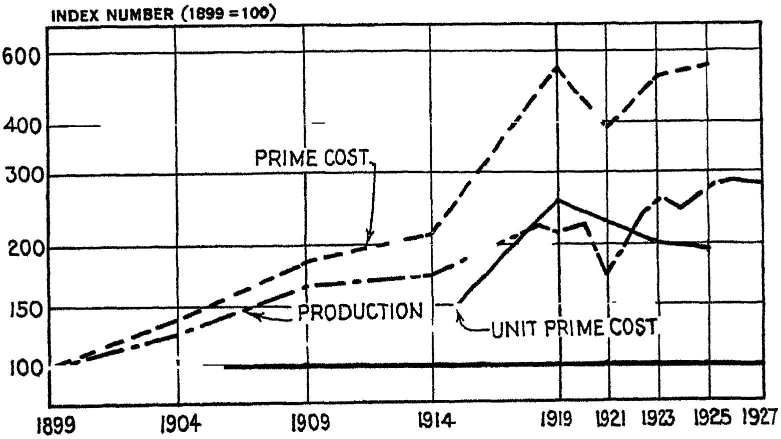

Chart 5 visualizes in comparison the changes in primary power, values of manufacturing buildings and machinery corrected for fluctuations in dollar value on the 1899 basis, and physical volume of production.

Chart 6 graphically compares the weekly wage rate, hours worked per week, and the unit prime cost. Wages paid, the product of hours worked multiplied by rate per hour, is one of the cost elements in prime cost.

Chart 7 has three curves—primary power, number of wage earners, and primary power per wage earner. The values for the first divided by the values for the second give those of the third.

CHART 5.—RELATIONSHIP OF PRIMARY POWER, VALUE OF MANUFACTURING BUILDINGS AND MACHINERY, AND PHYSICAL VOLUME OF PRODUCTION

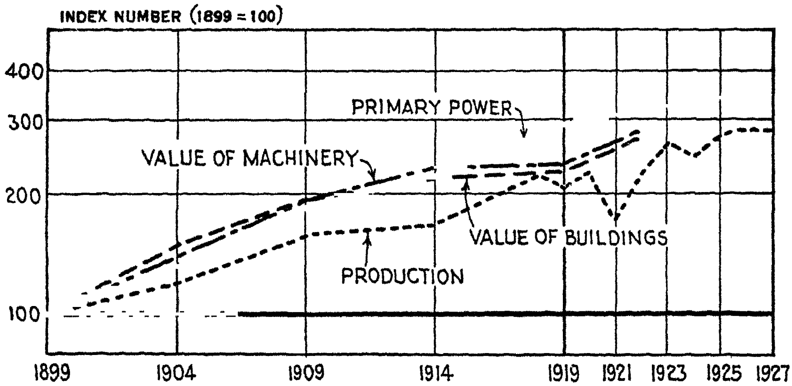

CHART 6.—RELATIONSHIP OF WEEKLY WAGE RATE, HOURS WORKED PER WEEK, AND UNIT PRIME COST

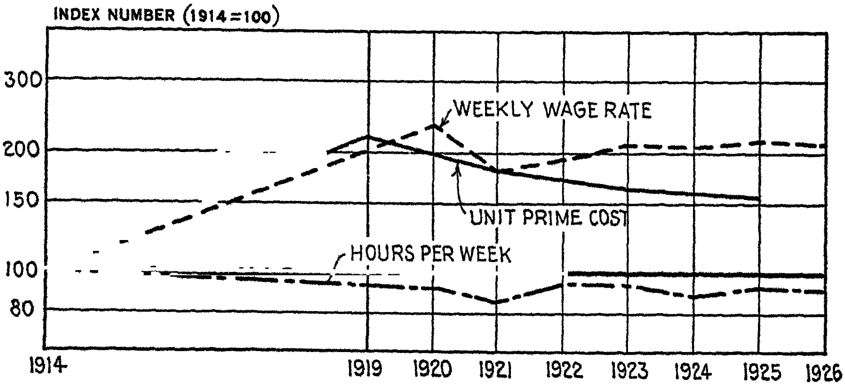

CHART 7.—RELATIONSHIP OF PRIMARY POWER, NUMBER OF WAGE EARNERS, AND PRIMARY POWER PER WAGE EARNER

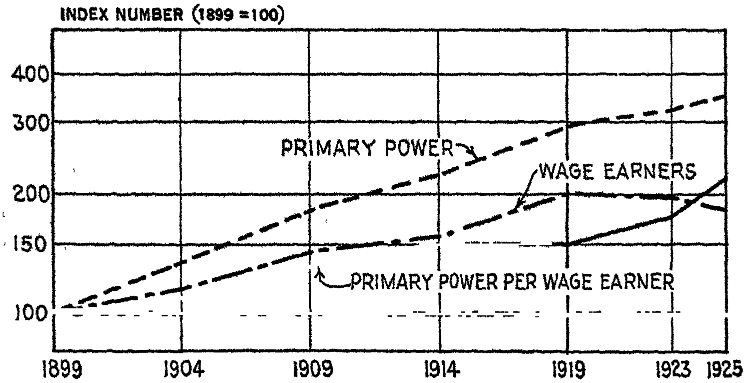

Table 2 gives for each of these 13 factors the terminal percentage change for both periods, 1899–1919 and 1919 to date of latest available statistics, and the average annual percentage change for each of these periods.

TABLE 2.—PERCENTAGE CHANGES FOR 13 PRODUCTION FACTORS
(Computed by method of least squares)

Factor	Percentage changes (increases except where otherwise noted)			
	Total	Annual	Total	Annual
	1899 to 1919	1899 to 1919	1919 to year shown	1919 to year shown
Production	112	5.6	46.5 (1927)	5.81 (1927)
Wage earners	103	5.15	−2.9 (1927)	−0.36 (1927)
Productivity	4.7	0.24	53.5 (1927)	6.69 (1927)
Primary power	205	10.25	22 (1925)	3.67 (1925)
Primary power per wage earner	47	2.35	30.9 (1925)	7 (1925)
Cost of materials	1,135	56.75	9.7 (1925)	1.62 (1925)
Wages paid	878	43.9	11.4 (1925)	1.9 (1925)
Value of buildings	123	6.15	26.7 (1922)	8.9 (1922)
Value of machinery	129	6.45	28.7 (1922)	9.6 (1922)
Prime cost	1,050	52.5	7.2 (1925)	1.2 (1925)
Unit prime cost	182	9.1	−24.5 (1925)	−4.08 (1925)
	1914–1920	1914–1920	1920–1926	1920–1926
Hours worked per week	−5	−0.83	0.9	0.15
Weekly wage rate	134	22.33	1.04	0.17

Physical Volume of Production.—The physical volume of product turned out by American manufacturing industry has increased steadily since 1899. There has been but one year of marked drop, namely, 1921. The year of greatest production was 1926, with a falling off of about 2 per cent from that year's volume in 1927. The percentage increase, taken from Table 2, from 1899 to 1919 is 112 per cent; the increase from 1919 to 1927 is 46.5 per cent. It is evident both from the statistics and charts that the sudden increase in production corresponds with the increase in productivity.

Number of Wage Earners.—The number of workers engaged in industry increased steadily from 1899 through 1919. There was a decided drop in 1921 which gave rise to the industrial unemployment of that year. The years 1922 and 1923 showed recovery, but the number engaged in the latter year was substantially lower than in 1919 and 1920. From 1923 to 1924 there was a drop with practically no change from that time through 1927. The percentage increase from 1899 to 1919, taken from Table 2, is 103 per cent; the decrease from 1919 to 1927 is 2.9 per cent. Thus, during the period of greatly increasing productivity, there has been a decrease in the number of workers employed.

Wages Paid.—The total cost of labor employed in manufacturing, that is, amount paid in wages, fluctuated widely up to 1919, with but comparatively little change thereafter. The total increase in percentage from 1899 to 1919 is 878 per cent. The total increase from 1919 to 1925 is 11.4 per cent.

Cost of Materials.—The total cost of materials of manufacture, that is, the amount paid for them in dollars, has shown a great increase from 1899 to 1919, with the sharpest rise in the last five years of that period, and a slight increase from 1919 to 1925, the last year for which data are available. The total increase in percentage from 1899 to 1919 is 1135 per cent.

Prime Cost.—Prime cost, the sum of labor and material costs, has fluctuated like the two factors upon which it depends. The changes are an increase from 1899 to 1919 of 1050 per cent and a slight upward trend from 1919 to 1925.

Primary Power.—The change in utilization of primary power is undoubtedly one of the most significant. There has been a steady increase in this production factor since 1899 to date. When plotted, the curve is nearly a straight line, indicating an approximately uniform rate of increase. The percentage increase from 1899 to 1919 is 205 per cent; from 1919 to 1925, 22 per cent.

Value of Manufacturing Buildings.—The value of manufacturing buildings on the 1899 base has increased at a more rapid rate than the increase in production up to the year 1922, the last one for which statistics are available for this factor. The percentage increase from 1899 to 1919 is 123 per cent, followed by a 26.7 per cent increase from 1919 to 1922. The growth has been somewhat uniform with, however, a point of flexure in 1919, corresponding in time to the beginning of the increase in productivity.

As an indication of the changes that have taken place since 1922, a statement has been prepared which gives the number of square feet of floor area of industrial buildings contracted for year by year, beginning with 1915.[2] The statement, expressed in square feet, is as follows:

1915	64,000,000	1921	36,000,000
1916	97,000,000	1922	66,000,000
1917	109,000,000	1923	62,000,000
1918	181,000,000	1924	41,000,000
1919	153,000,000	1925	59,000,000
1920	128,000,000	1926	68,000,000

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[2] The figures are not for the entire United States, but include the 27 most important industrial states, and are estimated to include 75 per cent of all the construction of manufacturing buildings. The states surveyed are: Maine, New Hampshire, Massachusetts, Rhode Island, Vermont, Connecticut, New York, New Jersey, Pennsylvania, Delaware, Maryland, Virginia, West Virginia, Illinois, Indiana, Ohio, Minnesota, Michigan, Wisconsin, Iowa, Kansas, North Carolina, South Carolina, North Dakota, South Dakota, Missouri, Nebraska.

The peak year for contracting for this additional manufacturing floor area was 1918, with 1919 and 1920 also high. For these three years the total, from the foregoing tabulation, is 462,000,000 square feet, an area which was undoubtedly in use and productive when the increase in productivity turned sharply upward in 1921. The corresponding area estimated for the entire United States is 616,000,000 square feet.

Value of Manufacturing Machinery.—The changes in the value of machinery employed in manufacturing on the 1899 base is similar to that for the value of buildings. There is a decided increase from 1899 to 1922, the last year for which figures are available. The percentage change from 1899 to 1919 is 129 per cent, with a further increase of 28.7 per cent for 1919 to 1922.

Average Hours Worked per Week.[3]—The reduction during the present century in the average number of hours worked per week in American manufacturing establishments had been pretty well realized by 1919. The reduction from 1914 has been at a uniform rate. The number of hours for the year 1914 is 51.5, while the corresponding figures for the years 1925 and 1926 are 48.2. There was a drop in the depression year of 1921, recovery in 1922 and 1923, and another slight drop in 1924. The average actual hours worked per week from 1914 to 1926, inclusive, are shown in the following statement:

1914	51.5	1923	49.2
1920	48.7	1924	46.8
1921	45.5	1925	48.2
1922	49.2	1926	48.2

Weekly Wage Rate.—The weekly wage rate has increased sharply from 1914 to 1919, with a slight tendency upward after 1920 to date. In this respect it continues the age-old relationship—when productivity increases, wages increase also. The increase from 1914 to 1920 has reached a point, indeed, which the increase from 1920 to 1926 has not yet attained. Average weekly wage rates from 1914 to 1926, inclusive, are shown in the following statement:

1914	12.54	1923	26.54
1920	29.37	1924	26.28
1921	23.60	1925	26.93
1922	24.04	1926	27.16

Productivity per Wage Earner.[4]—The factor, output or productivity per worker, is the quotient of the physical volume of production divided by the number of persons engaged. It is, therefore, a derived figure and is dependent upon the utilization of the production factors which have a direct bearing upon production, as this is the numerator of a fraction of which the number of persons engaged is the denominator. The percentage increase from 1899 to 1919 for this factor is 4.7; that is, it had changed but little during the first 20 years of the twentieth century. The change from 1919 to 1927 is 53.5 per cent, emphasizing once more the fact that significant changes must have taken place in a number of production factors at or just preceding the critical time, 1919–20.

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[3] A most useful figure which might advantageously be reported in future censuses of manufactures is the "man-hours worked per year." It would be far more significant and valuable than the figures of "average hours worked per week."

[4] See discussion of productivity per wage earner, pp. 96 and 104; also Chap. III, Construction, pp. 243 and 248; Chap. IV, Transportation, Part 1, p. 285; Chap. VI, Labor, p. 447.

Unit Prime Cost.—The unit prime cost of manufactured goods, which is the quotient of total prime cost divided by production, is directly influenced by those production factors that increase the efficiency of production, the more economical use of materials and labor, as well as fluctuations in prime commodity prices and wage rates due to market changes. Therefore, changes in unit prime cost reflect technical changes. The outstanding example of this fact since 1919 is the reduction in price of automobiles, which has steadily moved downward, largely because of changes in technical processes and manufacturing methods.

From another point of view, this factor is important as indicating the effect of the cost-reduction program of American manufacturers initiated at the close of the World War.

The changes are not unlike, but reversed to those that have taken place in the productivity of the wage earner. From 1899 to 1919 the percentage increase was 182 per cent. From 1919 to 1925 the decrease has been 24.5 per cent.

Primary Power per Wage Earner.—The changes in this factor have attracted as much general attention as those that have taken place in regard to productivity. Nearly as great an over-all increase has occurred since 1919 to 1925 as from 1899 to 1919. The latter figure is 47 per cent, while the former is 30.9 per cent.

To assist in determining which factors have undergone the greatest change since 1919, they have been divided into three groups. The first includes those which have had a sharp increase in annual total or rate; the second, the single one which has had a sharp decrease; the third, those whose changes in annual total or rate have been comparatively slight.

In the first group, the over-all percentage changes, from 1919 to the last date for which statistics are available, range upward from 22 per cent. In the third group, the corresponding percentages range downward from 11.4 per cent.

The following statement shows the nature and per cent of change in these factors following 1919 (see Table 2). The figures, computed by the method of least squares, express the general trend rather than the exact changes which have taken place.

Sharp increase following 1919:	
Production	46.5
Productivity per wage earner	53.5
Total primary power	22.0
Primary power per wage earner	30.9
Machinery and equipment	28.7
Industrial buildings	26.7
Sharp decrease following 1919:	
Unit prime cost	−24.5
Slight changes following 1919.	
Total wages paid	11.4
Total cost of materials	9.7
Total prime cost	7.2
Weekly wage rate	1.04
Hours worked per week	0.9
Number of wage earners	−2.9

The first factor group, the one with which we are principally concerned, includes three physical (or, for the purpose of this study, technical) factors: primary power, industrial buildings, and machinery and equipment. These deserve further investigation. A fourth, which should also be included, is materials and processes of manufacture. Owing to the absence of data on the physical volume of materials consumed in industry, the change in the effectiveness of material utilization cannot be studied quantitatively. It is known, however, that the post-war period has produced many new materials and has seen the development of many improved processes. All these factors are further studied in Section II.

II. SPECIFIC CHANGES IN CERTAIN TECHNICAL PRODUCTION FACTORS

The information and data upon which this part of the report is based have been secured from many sources and by a variety of means.[5] The report based upon this information is arranged in eleven subdivisions of the general topics outlined at the close of Section I. These are as follows:

1. Industrial research.
2. Products and materials.
3. Industrial processes.
4. Manufacturing waste.
5. Industrial power.
6. Power machinery.
7. Industrial buildings.
8. Manufacturing machinery.
9. Material-handling equipment.
10. Mechanical safeguards for plant and machinery.
11. Artificial illumination.

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[5] Operating data have come from manufacturing concerns, brought out either by correspondence or through personal contact in field work. The statistics are principally from the reports of the Bureau of the Census. Library research has secured technical data, more particularly in regard to industrial power, while a survey of current engineering literature, supplemented by correspondence, produced information of materials of manufacture, industrial processes, and material-handling equipment.

The number of items that might have been presented on each of the subtopics 2, 3, 4, and 9, was larger than reasonable space would allow. Therefore, 50 cases were arbitrarily determined upon as the maximum, those that seemed to be most typical being selected.

The extent of the case information on manufacturing operation, sought out, selected and analyzed in this part of the report as a whole, is shown by the list of subdivisions and the number of cases included in each, that follows. The total is nearly 1,100 items.

1. Industrial research	599
2. Products and materials	50
3. Industrial processes	50
4. Manufacturing waste	101
8. Manufacturing machinery	200
9. Material-handling equipment	50
11. Artificial illumination	38
Total	1,088

1. **Industrial Research.**—Fortunately for the purpose of this report, the National Research Council early in 1928 sent out a carefully prepared questionnaire to 5,000 manufacturing concerns in the United States, each having a commercial rating of $1,000,000 or over.[6] Inasmuch as 599 replies brought definite information, the tabulated results can be considered as an extensive assay of the industrial research situation as it exists to-day in American manufacturing. The questions asked sought to bring forth information as to whether or not a research laboratory existed, the nature of the program, amount of annual expenditures, nature of special facilities afforded to the industry, and whether or not the activities had been profitable.

The information furnished by the replies is compiled in Table 3. The control column at the left lists 40 industrial or manufacturing product groups. Then follow five columns indicating how far organized research work is done and the nature of the laboratory which is maintained, if any. The next six columns are concerned with the research program and show what objective or objectives are being sought through research. The balance of the table deals with expenditures and profit.

Classification.—The classification of industries adopted in Table 3 does not actually follow that of the Bureau of the Census but is in as close agreement with it as possible. In some instances, too few replies were received to form an individual industrial group, five having been arbitrarily fixed as the minimum. Therefore, combinations of certain groups were set up in a classification slightly different from that used by the Bureau of the Census. Various terms were used in the replies to characterize laboratories, including research, development, testing, and control. In the tabulation, development laboratories have been considered as belonging to the research group, and control laboratories as being devoted to testing.

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[6] The replies to this request for information were offered for our use through the kindness of Maurice Holland, director, Division of Engineering and Industrial Research, National Research Council

One classification, that of machinery (light), needs explanation. It includes such mechanical equipment as typewriters, carpet sweepers, radio sets, firearms, and the like.

Activities.—Of the 599 manufacturing concerns supplying information, 52 per cent reported that they carried on research as a company activity. Testing laboratories are conducted by 7 per cent, leaving 41 per cent reporting that no research work is being done.

In regard to co-operative research conducted through trade associations, engineering societies, universities, or endowed fellowships, 29 per cent reported that they were supporting such activities. An additional 15 per cent stated that they were considering extension of their research activities, and 11 per cent of those doing no research work at the present time reported that they are considering taking it up in the future.

While it cannot be claimed that these percentages apply to American manufacturing as a whole, for in any such assay the more approachable and progressive concerns reply with the greater readiness, these figures indicate something of the extent of industrial research and the attitude toward it on the part of industrial managers and executives.

Co-operative Research.—Certain industries lend themselves to co-operative research. Among them are those engaged in cement manufacture, leather tanning, and gas and electric utilities. These industries, in particular, depend to a large extent upon research conducted by various national associations. On the other hand, there are certain industries which prefer to carry on research in the individual concerns largely because of the highly competitive nature of the products. Examples of such industries are the manufacture of machinery, machine tools, drugs, cosmetics, and pharmaceuticals.

Research Programs.—It was possible to divide the programs submitted into five classes, the arrangement being in the order of importance:

1. Improved product or service, 67 per cent.
2. Reduction of production costs, 59 per cent.
3. Development of new fields of application, 40 per cent.
4. By-products and new materials, 30 per cent.
5. New products, 8 per cent.

Only a few, 12 in all, specifically mentioned the elimination and utilization of waste. However, from the nature of the replies the conclusion is justifiable that many concerns interested in this subject included this element in their program under the heading of "by-products and new materials."

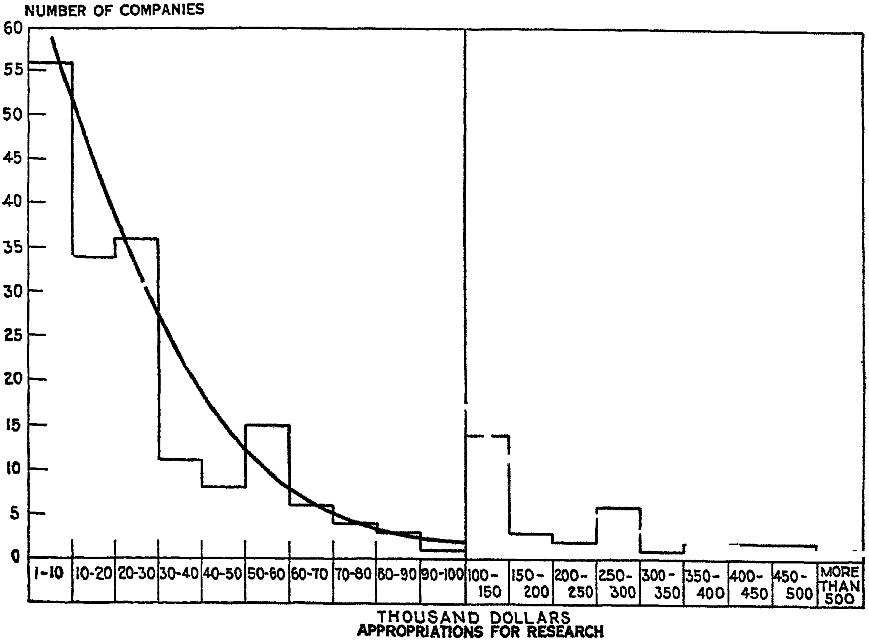
TABLE 3.—DATA ON INDUSTRIAL RESEARCH ACTIVITIES OF 40 MANUFACTURING PRODUCT GROUPS

Number of firms reporting	Industry	Extent of research being conducted					Research programs						Research expenditures and profit					
		Research laboratory or staff	Testing laboratory	No research work	Support co-operative research	Consider future activities	Improved quality of product or service	Reduced production cost	Development new fields of application	By-products or new materials	New products	Waste elimination and utilization	Number firms reporting	Annual research expenditure	Average expenditure reported	Number firms reporting amount increasing	Number reporting profit from research	Number reporting no profit from research
599	All industries	314	41	244	176	91	328	290	200	146	39	12	208	$11,991,637	$57,652	177	193	17
5	Agricultural machinery	1	.	4	1	1	3	3	3	2	1	...	.	. .	. .	1		
19	Automobiles and accessories	10	4	5	4	3	12	8	4	1	1	.	7	230,000	32,857	4	7	
8	Candy and confectionery	5	. .	3	1	. .	5	4	2	3	1	.	4	39,000	9,750	1	.	
5	Carpets and rugs	2	. .	3	1	2	3	4	...	.	. .	.	3	12,000	4,000	2	2	1
7	Cement manufacture	3	.	4	3	1	4	4	1	1	.	.	2	30,000	15,000	3	4	.
16	Ceramics, brick and clay products	8	1	7	7	5	8	8	5	3	1	.	9	358,089	38,787	8	7	.
34	Chemicals	28	..	6	9	8	24	23	18	17	4	5	20	1,707,500	85,375	20	15	1
7	Clothing	1	1	5	4	1	1	1	1	1	...		3	52,800	17,600	1	2	.
7	Dairy products	5	.	2	2	...	3	2	1	1	.	. .	2	262,000	131,000	3	2	.
17	Drugs, medicinal products and cosmetics	13	2	2	4	6	12	11	9	8	4	.	9	586,000	65,111	9	7	.
14	Electrical machinery and apparatus	12	1	1	2	3	12	8	7	2	1	..	8	1,127,000	140,877	8	4	1
24	Food products	13	1	10	7	4	14	10	8	7	4	.	7	505,000	72,143	4	8	1
6	Furniture	2	1	3	.	2	3	3	1	.	.	.	2	28,000	14,000		3	
19	Hardware	12	1	6	4	1	13	9	5	6	1	1	4	88,500	22,125	6	5	.
12	Instruments—measuring	8	. .	4	...	2	7	5	1	2	1	.	4	286,000	71,500	5	3	1
21	Iron and steel	12	.	9	9	3	9	10	8	4	2	1	5	81,400	16,280	6	5	
8	Knitting	3	.	5	5	2	4	2	2	1	. .	.	2	37,000	18,500	4	2	1
14	Leather and allied products	6	...	8	7	4	6	4	4	3	1	.	3	70,000	23,333	5	4	1
29	Lumber and allied products	4	...	25	13	4	9	6	5	8	1	..	3	53,500	17,633	2	4	2
13	Machine tools	6	1	6	3	1	6	5	5	2	.	...	2	75,000	37,500	1	3	1
45	Machinery	25	5	15	8	5	26	19	24	9	4		20	891,788	49,539	12	11	1
12	Machinery (light)	11	..	1	4	1	10	9	2	2	3	1	4	890,000	22,250	5	5	

6	Meat packers	1	.	5	5	. .	2	3	1	1	...	...	3	16,500	5,500	.	1	.
27	Metal products	11	1	15	5	4	14	13	7	5	...	..	6	274,500	45,750	3	7	1
7	Milling—flour	2	2	3	1	1	2	1	2	1	...	...	1	7,500	7,500	.	2	1
12	Nonferrous metals	10	.	2	7	5	9	9	7	5	1	1	9	269,000	29,888	7	8	.
10	Oil works and petroleum refining	6	1	3	7	3	6	7	3	2	1	.	5	911,000	182,200	3	4	1
6	Paints and varnishes	6	..	.	3	3	5	4	5	4	1	. .	4	112,000	28,000	4	5	..
41	Paper	26	4	11	10	4	27	28	13	12	. .	3	16	565,500	35,343	15	21	..
6	Pianos	3	1	2	. .	. .	4	3	. .	1	1	...	2	20,000	10,000	2	.	...
34	Public utilities (gas and electric)	9	5	20	17	..	10	12	11	4	1		10	841,500	84,150	6	11	..
6	Railway equipment	2	..	4	. .	1	2	2	1	1		.	1	7,500	7,500	.	1	. .
9	Rubber	5	1	3	.	.	5	5	1	1	1		2	125,000	62,500	3	3	..
10	Shoes	2		8	2	1	4	4	.	3	1		2	4,000	2,000	2	3	.
5	Silversmiths	3	. .	2	1	...	3	3	1	.	.		1	12,500	12,500	1	1	.
9	Steam specialties	5	2	2	4	4	5	4	3	2	.	.	2	565,000	282,500	3	3	
6	Stone and marble works	2	.	4	2	2	4	2	4	3	. .		1	6,000	6,000	1	2	1
31	Textiles	11	4	16	7	1	12	14	11	9		.	7	511,500	73,071	10	6	
8	Wire and wire specialties	3	2	3	5	2	7	6	5	2	1	. .	3	61,700	20,566	1	5	
24	Miscellaneous	17	..	7	2	1	13	12	9	7	1	. .	10	270,360	27,036	6	7	2

Expenditures.—The request for information as to annual expenditures was not generally replied to. A number of firms said that they kept no special accounts to cover industrial research activities and so were unable to furnish the information requested. However, 208 establishments reported annual expenditures to the total of $11,991,637. Expressed in averages, this total is $57,652 per year for each firm which reported its expenditures. Chart 8 shows the frequency of the various appropriations for research within this group of 208 concerns; $10,000 per year is the sum most frequently spent.

CHART 8.—FREQUENCY CURVE OF ANNUAL APPROPRIATIONS FOR INDUSTRIAL RESEARCH MADE BY 208 MANUFACTURING ESTABLISHMENTS



As to whether expenditures were decreasing or increasing, 58 per cent of those that reported stated that they were increasing year by year; 8 per cent stated that annual expenditures were remaining stationary, while only five establishments out of the total of 208 reported that their research budgets were decreasing.

Results from Research.—Of the 490 firms that conduct individual research work and support co-operative research, 39 per cent reported that their research activities had shown a profit. Seventeen firms reported that research had shown no profit. Twelve of these explained the situation by saying that they had not conducted research long enough to realize a profit from its results. And nearly all of this group believe that definite results will be attributable to their industrial research within the next year or two.

Mention has been made of the fact that many firms do not keep records of research expenditures. In this group are 73 firms that are conducting individual research or are supporting co-operative activities. In some cases the statement is made that research costs are allocated directly to products or are absorbed by general expenses

As to the ratio of profit to the amount expended, numerous estimates range from 100 to 300 per cent. One firm reported profit as "1,000 to 1."

2. Products and Materials.—*Fifty Typical Developments.*—Replies to a questionnaire brought a considerable amount of information in regard to both materials and manufactured products which had been developed and put on the market since 1918. Obviously such data do not lend themselves to a statistical or quantitative presentation. The only practicable course is to present a sufficient number of cases as an assay to indicate the nature of the discoveries and, so far as possible, give an evaluation of their economic importance.

A selection was made of 50 items which, taken together, give a fair idea of the spread of research work that has been done to develop new materials and new products for commercial use. Where possible, the quantity of the commodity produced and the accompanying reduction in cost or the technical advantages secured are given.

For convenience they are classified into the following 11 groups:

Cellulose products.
Chemicals.
Drugs and pharmaceuticals
Electrical apparatus.
Food products.
Metals.
Paints and varnishes.
Refractory materials.
Resinous products.
Rubber products.
Miscellaneous products.

Credit is given for each item, either to the manufacturing company that supplied the information, the United States Bureau of the Census or the United States Bureau of Standards.

Table 4 summarizes the data which are given in some detail in the following pages.

3. Industrial Processes.—*Fifty Typical Developments.*—In the cost-reduction program of American manufacturers the development of new processes to lower costs or to bring other savings has been a prominent part of research activities. This phase of industrial research was explored for this survey through a questionnaire sent to representative manufacturing companies and to laboratories engaged in such investigations.

The information received in reply has been compiled in the same manner as that on products and materials. That is, 50 typical developments have been selected, which, taken together, give an idea of the nature of the new processes that have been discovered and put to use since 1918, with an evaluation of their economic results.

Table 4.—Products and Materials for Manufacture

Product	Use and savings	Company
Cellulose Products		
Moisture-proof cellophane	Wrap for material for protection against water, gas, dust, germs, and fumes.	DuPont Cellophane Co.
Celluloid for safety glass	Nonshatterable glass—strong, clean, transparent, stable to light and heat	
Fish-scale substitute for making pearl celluloid	Possesses characteristics of fish scale at about 1/25 of cost	
Chemicals		
Maleic acid	May replace citric acid in many uses at materially lower cost	National Aniline & Chemical Co.
Zinc metal-arsenite	Wood preservative used as water solution.	Western Union Telegraph Co.
Phthalic anhydride	Now produced in this country at about 1/8 price of prewar importations.	
Ethylene glycol	Used in explosives manufacture and as anti-freeze material for automotive engines.	Mellon Institute of Industrial Research.
Drugs and Pharmaceuticals		
Ipral	Gives equivalent results when taken in smaller doses than required by other hypnotics	E R. Squibb & Sons
Novargentum	Powerful nontoxic, nonirritating, and nonstaining germicide.	E. R. Squibb & Sons
Electrical Apparatus		
B-battery eliminators	Radio sets. Saving to public about $15,000,000 per year	Westinghouse Electric & Manufacturing Co.
Trickle charger	For radio sets and railway signals Saving to public on radio sets about $2,500,000 annually.	Westinghouse Electric & Manufacturing Co
Autovalve lightning arrester	Has displaced old electrolytic type Annual saving about $1,000,000.	Westinghouse Electric & Manufacturing Co
Food Products		
Arkady yeast	Baking	Mellon Institute of Industrial Research.
Dry milk	Baking and export shipment	
Cellulose sausage casing	Replaces animal casings; is finer and edible.	Mellon Institute of Industrial Research.
Cane syrup	Supplements cane sugar	United States Census of Manufactures
Oleomargarin	Butter substitute	United States Census of Manufactures
Dried fruits and vegetables	Substitute for fresh products	United States Census of Manufactures.
Metals		
Copper oxide rectifier	Supplants electrolytic rectifiers	Union Switch & Signal Co.
Types of steel	Silico-vanadium steel for coil springs; carbon-vanadium steel for high temperature and high pressure work.	Vanadium Corporation of America.
Aluminum-silicon alloy	Supplants metallic aluminum as deoxidizer in manufacture of steel.	Vanadium Corporation of America.
Metallic tantalum	Electrolytic rectifiers, and for B-eliminators and trickle chargers.	Fansteel Products Co.
Sheet steel	For cores for electrical apparatus.	Westinghouse Electric & Manufacturing Co.

TABLE 4.—(*Continued*)

Product	Use and savings	Company
Nitralloy	Claimed to be hardest material so far produced in steel.	Ludlum Steel Co
Alloy steel	Substitutes for common iron and steel	United States Census of Manufactures.
Silicrome valve steels	Chiefly for exhaust valves in internal combustion engines	Ludlum Steel Co
Permalloy	An alloy of nickel and iron—can be cast into ingots, drawn, and rolled.	
Stainless steel	For all machine parts where ordinary steel can be used	
PAINTS AND VARNISHES		
Lacquer (cellulose acetate, plastics, film, and lacquers)	Supplements ordinary paint	United States Census of Manufactures
Tricresyl phosphate (lindol)	Oily liquid, noninflammable, nonvolatile, nonfreezing, odorless, colorless Used in lacquer industry.	
REFRACTORY PRODUCTS		
Diaspore clay refractories	Substitutes for bauxite	Laclede-Christy Clay Products Co
Artificial periclase	Used in electric furnaces for preparation of nonferrous alloys, high purity ferrochrome, ferromanganese, ferrotungsten	Sierra Mangansite Co.
RESINOUS PRODUCTS		
Laminated bakelite	Developed as veneer for wood finishes, Pullman car windowsills, etc	Bakelite Corporation.
Bakelite	Bond for grinding wheels	Bakelite Corporation.
Laminated bakelite	Used to replace rawhide in silent gears.	Bakelite Corporation.
RUBBER PRODUCTS		
Latex shoe cement	Used in shoe manufacture	Dewey & Almy Chemical Co.
Latex haircloth cement.	Used as fiber binder in clothing industry.	Dewey & Almy Chemical Co.
Latex compound	Can sealing compound	Dewey & Almy Chemical Co.
Cord type automobile tire	Supplanted fabric type of tire	United States Census of Manufactures
MISCELLANEOUS PRODUCTS		
Panchromatic motion picture film	Makes possible successful photography under incandescent lighting.	Du Pont-Pathé Film Manufacturing Co.
High-early-strength cement	Portland cement product of great fineness and strength.	International Cement Corporation.
Thermatomic carbon	Used in compounding rubber stocks for pneumatic tires.	Thermatomic Carbon Co.
Glass and glass substitutes	Pyrex glass for cooking utensils Quartz substituted for glass for certain purposes. Safety glass windows for automobiles. Ultra-violet windows substituted for glass in hospitals, etc.	United States Census of Manufactures.
Leather substitutes	Fabrikoid substituted for leather for binding books, etc.	United States Census of Manufatures.
Paper products	Paper to replace cloth products, such as towels and napkins, bags for cement, etc.	United States Census of Manufactures.
Rayon	Substitute for silk	United States Census of Manufactures.
Carbon dioxide ice	Substitute for water ice	United States Census of Manufactures.

TABLE 5.—INDUSTRIAL PROCESSES

Process	Process supplanted	Savings	Company
CHEMICAL			
Refining edible oils	Old processing tanks	¼ cost of old process	American Linseed Co
Eliminating corrosion in water circulating systems by use of sodium chromate.		$25,000 per yr in repair bills, $75,000 due to elimination of lost time in plant	Midwest Refining Co
Nitrocellulose lacquer			Hercules Power Co
Indurating wood with sulphur			Texas Guld & Sulphur Co
Recovering borax		Present production costs are less than 10 per cent of those of 1919	American Potash & Chemical Corporation
Refining sugar	Suchar used instead of bone char	Requires less suchar than process using bone char	Suchar Process Co
Mothproofing fabrics and furs			American Cyanamid Co
Cooking straw with sodium carbonate and sodium sulphite	Supplants use of lime mixture		Paper Mill Laboratories
ELECTRICAL			
Filament material for radio tubes	Using base metals in place of platinum for oxide coated filaments	Annual saving of about $3,000,000	Westinghouse Electric & Manufacturing Co
Automatic arc welding	Hand welding	Annual saving about $60,000	Cadillac Motor Car Co
Inert gas for electric transformers		Annual average saving about $5,000	Westinghouse Electric & Manufacturing Co
Oxide coated filaments		Saving to date about $900,000	Westinghouse Electric & Manufacturing Co
FUEL			
Tar distillation		Saving about $1,500,000	The Barrett Co
Low temperature carbonization of coal		Reduction of carbonizing time to two hours	International Coal Carbonization Co
Pulverized coal carbonization		Reduction of cost of boiler fuel burned by Central Stations	International Coal Carbonization Co
MECHANICAL			
Pressing linseed	Eliminates press cloths and about two thirds labor.	Four cents per bushel of linseed crushed	American Linseed Co.
Beating paper pulp with rods		Claims savings in power from 30 to 50 per cent	Paper Mill Laboratories (Inc)
Dry quenching	Cooling of hot substances by liquids	In a water gas plant, fuel saving of 2 3 pounds per 1,000 cubic feet gas made	Dry Quenching Equipment Corporation
Artificial periclase	Periclase produced in electric furnaces	About half of price of electric furnace product	Sierra Magnesite Co
Utilization of powdered coal	Stoker firing	Operating efficiency 6 to 8 per cent higher than for stoker firing	Combustion Engineering Corporation
Air preheating in boiler operation.		6 to 8 per cent reduction in fuel burned	Combustion Engineering Corporation
Emmet mercury process		Accomplishes large fuel savings	General Electric Co

METALLURGICAL			
Leaching process		Recovery of approximately 20,000,000 pounds copper per year, previously wasted	Calumet & Hecla Consolidated Copper Co
Centrifugal cast pipe manufacture	Sand-cast process	Reduction of equipment and labor Great savings in time	United States Cast Iron Pipe & Foundry Co
Hump method for hardening steel	Substitute for oil and gas fired furnaces	Increased operating efficiency	Leeds & Northrup Co
Homo method for tempering steel and heat treating aluminum	Supplants process of tempering by radiation type furnace		Leeds & Northrup Co.
Electric-thermic smelting		Reduced selling price of ferro-vanadium about 25 per cent	Vanadium Corporation of America
Electrolytic white lead process		Reduction of processing time	Anaconda Lead Products Co
PETROLEUM REFINING			
Cracking of heavy petroleum hydrocarbons.	Old pressure distillation type of apparatus	Reduction of fuel consumption about 80 per cent	Kansas City Testing Laboratory
De-waxing paraffin base lubricating oil stock.		Permits all-year-round use of same oil in high compression motors	Texas Pacific Coal & Oil Co
METAL WORKING			
Chromizing steel			General Electric Co
Drilling long oil holes..	Replaces method using two spindle horizontal machines	$6,000 per year	Cadillac Motor Car Co
Utilizing diamond tools	Old method of boring and reaming holes with steel tools.	Annual saving about $15,000	Cadillac Motor Car Co
Roughing outforging billets	Old swaging or fullering method	Annual saving about $20,000	Cadillac Motor Car Co
Tapping nuts		Annual saving $5,000 in addition to improved quality of product	Cadillac Motor Car Co
Arc welding	Riveting	Economies effected in time and labor	Newport News Shipbuilding & Dry Dock Co
RUBBER			
Automatic tube molding		Manufacturing costs reduced about 40 per cent and quality improved	Fisk Rubber Co
Fillerless cord tire production	Woven fabric tire	Improved product and reduction of waste by 33 per cent	Fisk Rubber Co
High pressure tube method	Eliminates "wet-wrapped" method	Reduced labor cost, improved quality of product.	Fisk Rubber Co
Semiflat tire building	Core-built and flat-band methods	Reduced production costs, improved product	Fisk Rubber Co.
Thermoprene process			B F Goodrich Co
Development of age resisters		Estimated savings to consumers about $50,000,000 per annum	B. F Goodrich Co
MISCELLANEOUS PROCESSES			
Filling gelatin capsules...	Old process of using stamping presses and hand labor		American Linseed Co
Elimination of crazing	Replaces process of drying pottery	Fuel savings from 75 to 85 per cent	Homer Laughlin China Co

For convenience they are classified into nine groups:

- Chemical processes.
- Electrical processes
- Fuel processes
- Mechanical processes
- Metallurgical processes.
- Petroleum refining.
- Metal working.
- Rubber processes.
- Miscellaneous processes.

Credit is given for each item to the company or laboratory that supplied the information.

Table 5 summarizes the data that are given in some detail in the following pages.

4. Manufacturing Waste.—A widespread, unified effort at manufacturing cost reduction and improvement in operating effectiveness has been extended, since 1921, through the waste elimination movement. Initiated by the report on Waste in Industry, of the American Engineering Council, it has been based on a definite and practical point of view.

> . . . Industrial waste has been thought of as that part of the material, time and human effort expended in production represented by the difference between the average attainments on one hand and performance actually attained on the other . . .

Minimizing or eliminating waste is a continuous process, for each new attainment opens the way for another on a higher level of effectiveness.

Development has been along three principal lines: simplification of product, standardization of product, and reduction of wastage.

The first of these, simplification, has been fostered by the United States Government through the Department of Commerce, acting with manufacturing organizations, distributors, and consumers. The second, standardization, has been an activity of manufacturers' associations and technical societies. The third, reduction of wastage, has become a function of plant operation.

No comprehensive data are available to indicate the economic value and savings of these lines of effort. But the nature of the work attempted and certain detailed results achieved can be presented.

Simplification seeks to reduce the types, sizes, and varieties of a line of manufactured product to the fewest possible number. If a group of manufacturers agree to produce and market this fewest number of varieties, simplification has been carried to the establishing of "Simplified Practice."

The extent of simplification is indicated by the fact that 84 commodity classifications have been reduced to Simplified Practice. They group into the following eight general subdivisions:

- Building materials.
- Business documents.
- Construction materials.
- Housekeeping supplies and furnishings.
- Mill supplies and equipment.
- Packages and containers.
- Plumbing supplies.
- Miscellaneous commodities.

The degree of reduction in varieties, ranging upward to as high as 98 per cent, is shown by the tabulation for the various subdivisions which follows:

Simplified practice recommendation number	Item	Reduction in varieties		Per cent reduction
		From	To	
	BUILDING MATERIALS—EQUIPMENT, FITTINGS, ETC			
7	Face brick, rough and smooth	75	2	97
	Common brick	44	1	98
12	Hollow building tile (first revision)	36	20	44
15	Blackboard slates	231	52	79
16	Lumber, softwood (second revision) [a]			
18	Builders' hardware (first revision) [b]			
	Items	6,948	5,130	26
	Finishes	100	29	71
30	Terne plate (weights)	9	7	22
43	Paint and varnish brushes	480	143	70
47	Tacks and nails:			
	Sizes	421	182	57
	Packing weights	423	121	71
48	Shovels, spades, and scoops (first revision)	5,136	2,178	57
49	Sidewalk lights:			
	Sizes	120	6	95
	Styles	80	5	94
	Shapes	10	2	80
52	Staple vitreous china plumbing fixtures	441	58	87
61	White glazed tile and unglazed ceramic mosaic [c]			
72	Solid section steel windows	42,877	2,244	95
75	Composition blackboard			
	Colors	3	1	66
	Widths	18	8	55
	Lengths	90	13	86
82	Hollow metal doors	[d]	45	
83	Kalamein doors	[d]	36	
	BUSINESS DOCUMENTS			
34	Warehouse forms	Thousands.	15	
37	Commercial forms	Thousands	3	
50	Checks, notes, etc	Thousands	[e]	
	CONSTRUCTION MATERIALS			
1	Vitrified paving brick (sixth revision)	66	5	92
3	Metal lath	125	24	81
4	Asphalt (first revision)	102	10	90
9	Woven wire fencing	552	69	87
	Woven wire fence packages	2,072	138	93
14	Roofing slates			
	Descriptive terms.			
	Thicknesses and sizes	98	48	51
19	Asbestos mill board (first revision), sizes, thicknesses	21	4	81
	Asbestos paper (first revision), sizes, widths, and weight of rolls	72	17	78
26	Steel reinforcing bars, cross-sectional areas.	32	11	66
29	Eaves trough and conductor pipe	21	16	24
32	Concrete building units (length, width, and height of blocks, tile, and brick)	115	14	88
38	Sand lime brick (length, width, and height).	14	3	79
53	Reinforcing spirals	7	4	43
	HOMES, HOTELS, HOSPITALS, CLUBS, ETC, GENERAL SUPPLIES AND FURNISHINGS			
2	Beds, springs and mattresses	78	4	95
5	Hotel chinaware	700	214	69
10	Milk bottles and caps (first revision)			
	Bottles	49	4	92
	Caps	10	1	90
11	Bed blankets (sizes)	78	12	85
24	Hospital beds			
	Lengths	33	1	97
	Widths { Standard Special }	34	{ 1 2	} 91
	Height	44	1	98
33	Cafeteria and restaurant chinaware	700	243	65
35	Steel lockers	65	17	74
39	Dining car chinaware	700	276	61
40	Hospital chinaware	700	279	60
54	Sterling silver flatware	190	61	68
55	Tinware, galvanized and japanned ware	1,154	873	24
74	Hospital and institutional cotton textiles	575	26	95
80	Folding and portable wooden chairs [f]			
85	Adhesive plaster:			
	Rolls	3	2	33
	Spools			
	Widths	8	5	38
	Lengths	23	13	43

Simplified practice recommendation number	Item	Reduction in varieties		Per cent reduction
		From	To	
86	Surgical gauze (construction)	15	7	53
91	Clinical thermometers	[d]		
	MILL SUPPLIES, SHOP EQUIPMENT, ETC			
6	Files and rasps .	1,351	475	65
17	Forged tools (first revision)			
	Tool heads	665	361	46
	Eye sizes .	120	10	91
23	Plow bolts	1,500	840	44
28	Sheet steel (first revision)	1,819	261	85
36	Milling cutters	944	570	40
45	Grinding wheels (first revision)	715,200	254,400	64
51	Die head chasers (for self-opening and adjustable die heads) .	[d]		75
56	Carbon brushes, and brush shunts [g]			
63	Metal spools (for annealing, handling, and shipping wire)	[d]	6	
71	Turnbuckles .	248	115	54
79	Malleable foundry refractories	188	15	92
	PACKAGES, CONTAINERS, ETC			
41	Insecticides and fungicides (packages)	38	22	42
42	Grocers' paper bags	6,280	4,700	25
60	Packing of carriage, machine, and lag bolts	[d]	18	
68	Flashlight cases (metal and fiber)	25	14	44
69	Packing of razor blades (systems of packing)	2	1	50
70	Salt packages . .	35	19	46
	PLUMBING			
8	Range boilers .	130	13	90
13	Structural slates for plumbing and sanitary purposes	827	138	83
21	Brass lavatory and sink traps	1,114	76	93
25	Hot water storage tanks	120	14	88
57	Wrought iron and wrought steel pipe, valves, and pipe fittings:			
	Sizes of valves and fittings	20,000	19,238	4
	Sizes of pipe	62	49	21
	MISCELLANEOUS EXAMPLES OF SIMPLIFIED PRACTICE			
20	Steel barrels and drums .	66	24	64
22	Paper . .	[d]		
27	Cotton duck (first revision) .	460	86	81
31	Loaded shells (second revision) .	4,076	768	61
44	Box board thickness .	244	60	75
46	Tissue paper			
	Roll tissue . . .	13	3	77
	Shoe tissue .	21	6	71
58	Classification of iron and steel scrap [h]			
59	Rotary cut lumber stock for wirebound boxes:			
	Length	102	6	94
	Width	65	6	91
	Thickness .	9	6	33
62	Metallic cartridges .	348	256	26
66	Brake lining (automobile) .	[d]	[i] 37	
67	Roller bearings	[d]	[i]172	
73	One-piece porcelain insulators.. .	272	210	23
76	Ash handles (grades)	[d]	3	
77	Hickory handles (grades) .	[d]	11	
81	Binders' board	718	10	98
84	Composition books .	86	41	52

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[a] Standard nomenclature grades for sizes of softwood.

[b] These figures are average reduction in catalogue items in 1922 of four leading manufacturers of builders' hardware, as result of simplification

[c] Shapes, patterns, dimensions, grade nomenclature, grade marks, grade specifications, and certifications of grades, for white glazed tile and unglazed ceramic mosaic.

[d] Original total not known

[e] One size for each instrument.

[f] Elimination estimated by industry as 20 per cent in portable chairs and 19 per cent in folding chairs

[g] Increments of increase in dimensions, and dimensional tolerances for carbon brushes, sizes of holes or slots in terminals for flexible shunts, and size and specifications for cable for brush shunts.

[h] Specification for scrap.

[i] Society of Automotive Engineers' Standards

Herbert Hoover, when Secretary of Commerce, estimated the savings to American manufacturers from simplified practice and the application of the recommendation of the Report on Waste in Industry as upward of $600,000,000 annually. This part of the movement to eliminate waste in manufacturing may be credited with a total saving to-day of some five billions of dollars, on the basis of Mr. Hoover's estimate.

The extent of the adoption of standardization, the engineering determination of sizes, dimensions, and proportions of manufactured products, cannot be determined. A mere list of the standards adopted conveys little significant information. Neither is it possible to give an economic valuation of the benefits and savings that have come from their use. The American Engineering Standards Committee is the authority for the following statement:

> Standardization is to-day the most important approach to greater industrial efficiency. Actual savings that are now being made in the automobile industry through organized standardization activities are estimated by the industry itself at 750 million dollars a year.

Elimination of waste in the plant has dealt with many kinds of losses. During the month of October, 1927, the Newport News Shipbuilding and Dry Dock Co. secured from its supervisory and working forces some 2,770 suggestions for the elimination of waste in the plant. A classification of these, presented by William B. Ferguson, production manager, and A. A. Giese, secretary of the Waste Committee, is given in the accompanying tabular form. The 39 items and 23 actions are indicative of the kind and nature of the activities being carried on throughout American industry to lessen, avoid, and eliminate wastage. The total number of classes of intraplant waste is 148. Mr. Ferguson estimates that $250,000 will be saved annually when all these suggestions have been made effective. That amount is at the rate of about $50 per employee per year.

Another aspect of waste elimination contributed to largely by industrial research is the reclamation and reuse of materials and the development of commercially valuable by-products. Table 6 gives 50 examples of each of these kinds of saving. Here also it is impossible to make any decided estimates of the value to industry and to the nation of the savings thus effected. In one case alone, that of reclaimed rubber, the figures ran to over twenty millions in 1925.

5. Industrial Power.—In a preceding part of this report it has been shown that the increase in the primary power available to each worker in manufacturing establishments is one of the most important and significant changes which have taken place since 1919. This is not the only significant change in industrial power utilization. There have been increases in the installation of electric motors to supply mechanical power in manufacturing, in the amount of power purchased instead of generated by

CLASSIFICATION OF APPROVED WASTE WEEK SUGGESTIONS

(Figures indicate number of suggestions in that class)

Items	Products	Machinery	Equipment	Building and structures	Tools and patterns	Materials	Soliciting	Accidents and treatment	Restaurant	Smoking	Working hours & attendance	Stationery forms	Drafting forms	Direct labor	Indirect labor	Stores	Lights	Drinking water and ice	Drafting	Office depts	Power, heat, light, air & water	Indirect depts	Reports and records	Supervision	Apprentices and new men	Welfare	Waste elimination	Plant orders	Wage incentives	Organization	Fire protection	Stationery	Inventory and investments	Communications	Expense	Wage scales	Personnel	Budgets	Costing and accounting	Total	Classes
Addition to	1	9	41	7	2	1										1		1					3			3			1					2			1	2		75	14
Design of	24	4	20		14	9						5	3				6				1							1			1									88	11
Methods	48	1			7	9			1		7			9					23		4		2	2		4	6	2	3	4				4		2	3		4	145	20
Organization								1						7	1				2	2		2					1										1			17	8
Quality			1		3	2																		8					1								1			16	6
Purchasing					1	6																																		7	2
Maintenance			2		4															1																				7	3
By-products and salvage	1	1	4		3	27																																		36	5
Routing	6	1				1													1									2												11	5
Quantity			1											2									1																	4	3
Miscellaneous																			1																					1	1
Rules							1			1										1																				3	3
Planning	19		4			9							3	5					3			3	1					3												50	9
Control	4		3		2	18		5			1		6	5			2				5		2									8	2		2		4			69	15
Storage			1		3	3																																		7	3
Follow-up and tracing						2																																		2	1
Investigation and inspection	12	3	1		2	6														1	1																			26	7
Repair		4	2	6	1																																			13	4
Standardization	10	2	11		6	15							3							1			4																	52	8
Care or preservation	5		1			3						2							5																	1				17	6
Instructions													1	3					2					1	3												4			14	6
Selling	2																																							2	1
Move or rearrange		3	3	2		2					1						3														1									15	7
Total	132	28	95	15	48	113	1	6	1	1	9	7	16	31	1	1	11	1	37	6	11	5	13	11	3	7	7	8	5	4	2	8	2	6	2	3	14	2	4	677	148

TABLE 6.—EXAMPLES OF REDUCTION OF MANUFACTURING WASTE

PART 1.—FIFTY CASES OF RECLAMATION AND REUSE

Waste	Process	Use
Aluminum borings	Separated from scrap heap and cleaned.	Sold separately at higher price
Babbitt and lead, from worn-out bearings.	Removed and remelted.	Reused
Battery lead	Melted	Reused.
Belting, worn and greasy	Cleaned, reconditioned	Lighter use.
Bolt head dies	Reground.	Reused
Bolts and nuts with worn threads	Cleaned and recut	Reused (in one plant over one ton of these are reclaimed daily).
Broaches	Reground and reworked to smaller sizes.	Reused.
Brooms and brushes	Trimmed	Rough work.
Burlap from incoming shipments	....	Outside of bales of scrap cloth.
Burlap sacks containing raw materials	Resold to shipper.	Reused.
Bushings	Removed from machinery	Reused.
Cardboard boxes and cartons enclosing raw materials.	Recut to desired sizes	Used for packing products.
Carpet and upholstering material scrap.	....	Used in packing automobiles, especially for export.
Cement mill dust	Electrical precipitation	Returned to process
Copper wire	Reworked	Cables or wire screens.
Cutting oils	Removed from finished materials and scrap by centrifugal separators.	Reused.
Dies, discarded due to faulty design, or worn out.	Annealed, threads recut, hardened.	Reused.
Drills	Reground to smaller sizes	Reused.
Excelsior, clean, received in incoming shipments.	....	Used in shipping room with clean and new excelsior.
Files, worn out	Cleaned and refiled by sand blast method.	Reused.
Flashlight batteries, worn out	Zinc removed	Reused.
Gages	Reground	Other uses
Grinding wheels	Edges trued and reconditioned	Reused (2,319 wheels repaired in one month at saving of $7,475 in one plant; savings in another plant $1,500 per month).
Hammers	Reconditioned	Reused.
Iron filings	Reclaimed	Certain manufacturing processes.
Iron pipe	Cleaned and painted	Replaced in stock.
Liquor, waste sulphate process	Soda reclaimed	Returned to sulphate process.
Lumber used for car braces and packing in incoming shipments	Cleaned and cut	Reused for export shipment.
Lumber, short length	....	Reused.
Metal borings and turnings	Remelted after cutting oil has been removed.	Reused.
Metal punchings, cheap	Refining	Reused, washers and gaskets.
Nails in board ends	Removed by magnets	Sold as metal scrap.
Oil used in testing motors	Separated from turnings and cleaned.	Reused.
Paper from incoming shipments	Baled	Sold

TABLE 6.—(*Continued*)

Waste	Process	Use
Paraffin from coating of clippings obtained in manufacture of drinking cups	Recovered	Reused
Rags for cleaning automobiles	Washed	Reused
Reamers	Reground and reconditioned	Reused.
Rivet shears	Old blades cut off, new ones rewelded.	
Rubber and leather scrap.	Sterilized	Soling and patching shoes worn by men around plant—in wet places and where hot metal is handled.
Rubber[a]	Reclaimed	Mechanical rubber goods
Sal-ammoniac skimmings	Reclaimed	For ammonia and zinc contents
	Refined	Used as soldering acid
Saw blades	Reconditioned	Reused
Sheet material, metal and nonmetal.	Co-ordination of design so that parts which would be scrapped for one product become raw material for another	Reused.
Sheet steel scraps	Recovered	Reused (savings in some cases amount to 50 per cent of new material purchased).
Solvent.	Recovered at rate of 100 gallons per day in one factory (would otherwise contaminate atmosphere).	
Stock clippings obtained in manufacture of drinking cups	Reworked	Cheaper furnishes
Sugar bags	Reclaimed	Used in place of cheesecloth for wiping and dusting purposes, or can be torn open and sold to furniture dealers
Syrup	Reclaimed from syruping machines, cleaned.	Reused.
Tin cans.	Tin and steel reclaimed	Reused in new cans (one ton of "empties" yields about 18 pounds of tin).
Wooden boxes and cases containing material for manufacture.	Cleaned, markings removed	Reused or taken apart and made into boxes for shipping finished products.

[a] Production of reclaimed rubber during the past ten years, in long tons, is as follows: 1919, 81,366: 1920, 86,395; 1921, 36,725; 1922, 57,834, 1923, 74,766; 1924, 80,079; 1925, 132,930; 1926, 180,582; 1927, 189,144.

The United States Census of Manufactures quotes the following figures on the value of reclaimed rubber for sale as such: 1919, $20,173,040; 1921, $7,424,453; 1923, $11,714,438; 1925, $23,020,517.

TABLE 6—(*Continued*)

PART 2—FIFTY CASES OF UTILIZATION THROUGH BY-PRODUCTS

Waste	Process	Product	Use
Acid waste from tin plate.	Chemical	Copperas	Red paint Ink.
Bagasse	Mechanical and chemical	Paper	Field cover to control weeds. Insulating board
Beet pulp	Drying	Stock feeds	Hydraulic cements.
Blast furnace slag	Mechanical and chemical.	Cements.	
Blood.	Mechanical	Fertilizers	
Bones	Mechanical	Buttons Fertilizer Ornaments	
Calcium chloride	Drying and crystallization.	....	On highways
Cans, tin	Electrochemical	Tin tetrachloride	Silk weighing.
Cement mill fumes	Electrical precipitation	Potash salts	Fertilizers. Glass and soap.
Chlorine	Chemical	Bleaching powder	
Chlorine from caustic soda industry	Chemical	Chloroform	In anaesthesia
		Carbon disulphide	Manufacture of carbon tetrachloride.
Copper refinery sludge	Chemical	Silver Gold	
Corncobs.	Chemical	Furfurol (aldehyde)	Synthetic resins. Paint remover Solvent for gelatinizing agent for nitrocellulose and cellulose acetate. Motor fuel. Fungicide, germicide, and preservative. Dyes. Anaesthetic. Plastic.
	Chemical	Adhesive "A"	Substitute for silicate of soda used in fiber container and wallboard manufacture. Substitute for dextrine and other organic gums and glues. Sizing of walls previous to applying paper.
	Chemical	Adhesive "B"	Used in manufacture of briquettes and as a core binder.
	Chemical	Cellulose	Has high absorption power excellent for blotting papers. Substitute for wood flour in manufacture of dynamite and plastics.
	Chemical	Oxalic acid	

TABLE 6—(*Continued*)

Waste	Process	Product	Use
Cottonseed	Mechanical and chemical	Oil Stock feed Linters	Paper and nitrocellulose products
Cull, citrus fruits	Chemical	Pectin Citric acid	Jelly-making Soft drinks
Fabric	Mechanical and chemical	Felt	Prepared roofing
Ferric oxide from aniline oil manufacture	Mechanical and chemical		Red paint for iron
Fish scrap	Mechanical	Fertilizer ingredient	
Flax straw	Mechanical and chemical	Paper pulp	
Flaxseed	Mechanical	Floor coverings	
Fluorine	Chemical	Fluorides	Metal enamels
Garbage	Chemical and mechanical	Glycerin Greases and oils Fertilizer	
Gases from beehive coke ovens.	Chemical and mechanical	Coal-tar by-products	In synthetic organic chemicals
Gasoline in natural gas	Chemical and mechanical	Casing head gasoline	Motor fuel
Helium in natural gas	Mechanical and chemical	Helium	In dirigibles
Hoofs and horns	Chemical .	Glue	
Hydrogen	Chemical		Hydrogenating oils or nitrogen fixation
Iodine from nitric acid manufacture	Chemical .	Iodine	In medicines
Kernels.	Chemical	Oils, pastes	Food
Linseed oil, press cake from	Mechanical .		Cattle feed
Lye liquors from soap manufacture	Chemical	Glycerin	
Molasses . .	Fermentation	Alcohol	Industrial and scientific uses
Molasses fermentation waste	Calcination .	Potash .	Agriculture
Oat hulls .. .	Chemical . .	Furfurol	Synthetic resins
Paper	Mechanical and chemical	Cardboard Low-grade paper .	Wrapping paper. Cartons, boxes, etc.
Paper waste	Mechanical and chemical	Papier-maché . Wall board	
Photographic fixing solutions. . .	Chemical	Silver .	
Powder, smokeless, low-grade.	Chemical	Pyraline	Handles, ornaments, etc.
Pyroligenous acid from charcoal production	Chemical	Acetic acid . . Methanol . . . Wood tar	
Rubber industry, cuttings from.	Mechanical and chemical.	Roofing	
Sawdust	Chemical and germentation	Alcohol...	
Selenium from copper refining.	Chemical . .	Selinum.... . ..	Glass manufacture. Electrolytic cells.
Shells (of fruit pits and nuts)	Charring . ..	Charcoal .. .	For fuel In gas masks.

TABLE 6.—(*Continued*)

Waste	Process	Product	Use
Smelter fumes	Electrical precipitation	Arsenic	Insecticides. Fungicides.
Steffens' waste from beet sugar manufacture	Evaporation and calcination	Potash salts	Fertilizers.
Sulphate pulp mill waste	Chemical	Turpentine	
Sulphur dioxide fumes from metals	Chemical	Sulphuric acid	
Wood, waste	Mechanical and retorting	Charcoal acetates	Manufacture of acetic acid
		Methanol wood flour	Dynamite and linoleum
Wool-scouring waste liquors	Acid cracking centrifugal.	Fertilizer Neutral grease Potash Nitrogen Filler (sand and dirt)	
Typical savings made in one plant[b]			
Department refuse and sweepings.	Chemical	Precious metals	Reused.
Junk cable	Mechanical	Paper	To paper mill
Junk cable	Mechanical	Copper	To copper mill.
Junk cable	Mechanical	Lead	Reused.

[b] Savings on these four items represent: .05 of total savings for 1919 to 1923; .08 of total savings for 1924; .09 of total savings for 1925; 13 of total savings for 1926; 21 of total savings for 1927.

manufacturing establishments, and in the efficiency of prime movers. The first two of these trends account, in part, for the rapid development of electric public utility companies. The increase in the capacity of prime movers which supply power to manufacturing establishments is a rough measure of the increased use of machinery by those establishments.

The change whereby the total amount of owned power in manufacturing has decreased slightly since 1919, and the purchased power supplied through electric motors has increased considerably in the same period, indicates a shift which is often referred to as from a "machine civilization created by steam power to a machine civilization created by electric power." Dr. Glenn Frank, president of the University of Wisconsin, has drawn this contrast:

> In a machine civilization created by steam power, the worker must go to the power, but in a machine civilization created by electric power, the power can be taken to the worker; and that is a revolutionary fact which means that when we say "machine civilization" in terms of 1950, we may be dealing with a machine civilization that is as different as imagination can conceive from the machine civilization which began when James Watt first harnessed the expansive power of steam to the processes of production.[7]

Increase in Electric Motor Power.—The electric motor first appeared as a factor in industrial power in 1899, the amount of power purchased at that time and applied through electric motors being but 1.8 per cent. So rapid has been the increase, however, that in 1927, the last year for which we have statistics, nearly 50 per cent of the power applied in manufacture was by means of electric motors operating on purchased power.

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[7] Address delivered at the Midwest Power Conference, Chicago, February 14 to 17, 1928.

The statistics which show this growth are given in Tables 7, 8, and 9.

TABLE 7.—INDUSTRIAL POWER MACHINERY IN THE UNITED STATES

(Horse power)

Year ending Dec 31	Steam engines and turbines	Internal combustion engines	Water wheels and turbines	Total, own power	Electric motors operating on purchased power	Total prime movers in industry[a]	Elec motors on purchased power is per cent of total
1899	8,189,564	134,742	1,454,112	9,778,418	182,562	10,097,893	1.8
1904	10,917,502	289,423	1,647,880	12,854,805	441,589	13,487,707	3.3
1909	14,228,632	751,186	1,822,888	16,802,706	1,749,031	18,675,376	9.4
1914	15,591,171	988,591	1,826,413	18,409,941	3,884,724	22,290,899	17.4
1919	17,036,210	1,241,829	1,765,131	20,043,170	9,284,499	29,327,669	31.7
1923	16,700,903	1,224,262	1,803,310	19,728,565	13,365,663	33,094,228	40.4
1925	16,916,856	1,186,116	1,800,828	19,903,800	15,868,828	35,772,628	44.4
1927[b]	16,911,088	1,170,759	1,784,962	19,896,819	19,143,744	39,040,563	49.0

[a] Includes in earlier years a small amount of "other rented power," chiefly through belts or shafting from other establishments.

[b] Figures for 1927 are preliminary.

Source: *United States Census of Manufactures*

TABLE 8.—AMOUNT OF TOTAL PRIMARY FACTORY POWER APPLIED THROUGH ELECTRIC MOTORS

(Horse power)

Year ending Dec 31	Total primary power[a]	Total horse power in electric motors	Operated by energy generated in plant	Operated by energy from central stations	Per cent electrified[b]
1899	10,097,893	492,936	310,374	182,562	5
1904	13,487,707	1,592,475	1,150,886	441,589	12
1909	18,675,376	4,817,140	3,068,109	1,749,031	25
1914	22,290,899	8,823,254	4,938,530	3,884,724	39
1919	29,327,669	16,253,702	6,969,203	9,284,499	55
1923	33,094,228	22,151,997	8,819,217	13,332,780	66
1925	35,772,628	26,123,573	10,254,745	15,868,828	73
1927[d]	39,040,563	30,360,026	11,216,282	[c]19,143,744	78

[a] From 1914 onward, this table eliminates all establishments reporting products under $5,000 in value. In addition, items covering establishments engaged in automobile repairing have been omitted.

[b] Primary horse power embraces prime movers driving industrial motors; these prime movers are about 89.5 per cent of the capacity of the motors connected to them, not all of which are ever in operation at any one time. For this last column the horse power of motors operated by energy generated in the plant itself has been scaled down accordingly.

[c] Operated by energy from purchased current.

[d] Figures for 1927 are preliminary.

TABLE 9.—EXTENT OF ELECTRIFICATION OF 16 MAJOR INDUSTRIAL GROUPS

Industrial group	Electrically operated machinery, per cent of total prime movers		
	Operating on purchased electricity	On electricity made locally	Per cent of total power
Machinery manufacture	69.8	25.9	95.7
Transportation equipment[a]	68.4	26.7	95.1
Rubber products	67.4	27.0	91.7
Nonferrous metals, etc	60.4	29.2	89.6
Tobacco products	39.6	47.5	87.1
Leather products	46.5	36.8	83.3
Railroad repair shops	62.0	20.2	82.2
Stone, clay, glass, etc[b]	54.1	26.3	80.4
Musical instruments	39.7	39.1	78.8
Textiles and their products	41.4	33.2	74.6
Food and kindred products[c]	49.8	15.9	65.7
Chemical and allied products[d]	37.6	27.2	64.8
Paper and printing, etc	33.3	29.6	62.9
Iron, steel, etc	32.4	25.7	58.1
Lumber and allied products	25.1	22.1	47.2
Miscellaneous industries	70.3	13.0	83.3
Total All industries	[e]44.4	[e]25.6	[e]70.0

[a] Automobiles, motorcycles, bicycles, carriages, locomotives, cars, ships, etc.

[b] Including the cement industry which is said to be 100 per cent electrified

[c] Including refrigeration.

[d] Including manufactured gas, coke, fertilizers, distilleries, petroleum refining, etc.

[e] Weighted average

Source *United States Census of Manufactures*, 1925

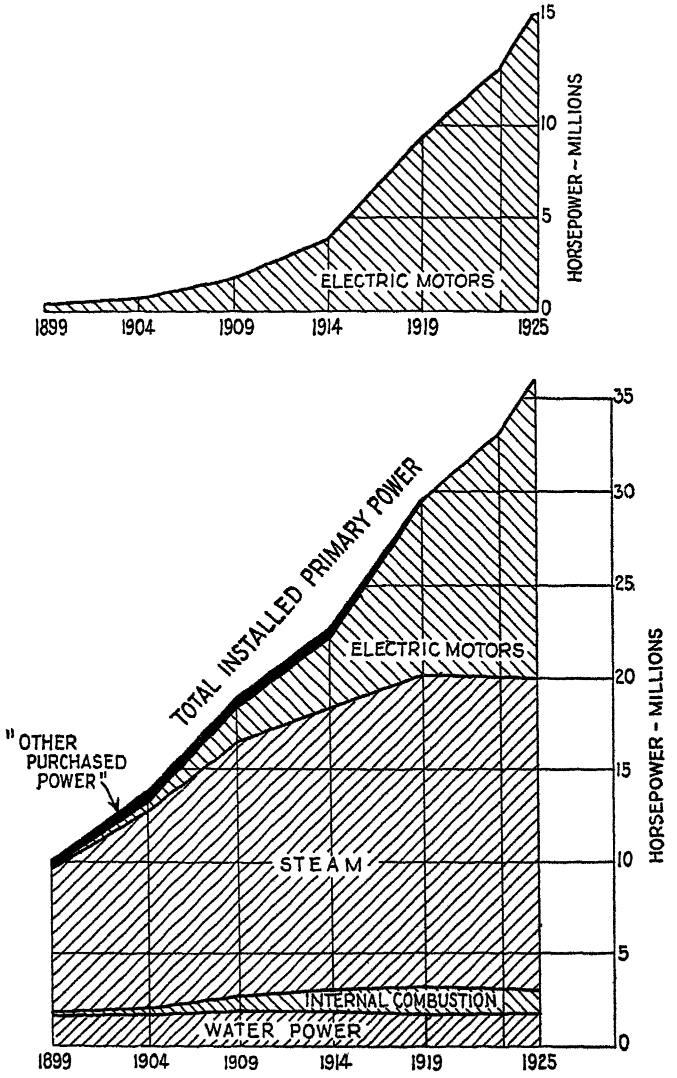
The first of these tables, Table 7, shows that from 1919 to 1927 there has been a growth of electrical horse power, and a decrease in all classes of mechanical power.

Table 8 shows the amount of total primary power in factories which is supplied through electric motors, the current being both self-generated and purchased. The growth has been from 5 per cent in 1899 to 55 per cent in 1919 and to 73 per cent in 1925. That is, the growth from 1919 to 1925 has been 17 per cent. Table 9 shows the extent to which manufacturing machinery is electrically operated in 16 industrial groups, the range being from 95.7 per cent in the manufacture of machinery to 47.2 per cent in the production of lumber and allied products.

Chart 9 shows graphically the relationships of the power supplied by water power, internal combustion engines, steam, and electric motors, while Chart 10 shows the relationship between mechanical and electric power in the factories of the United States.

Purchased Power.—Chart 10 also shows graphically the increase in the amount of purchased power which to-day is about one-half that used in the industry. So rapid has been this shift that it has frequently been said that the isolated power plant is doomed. A statement of this

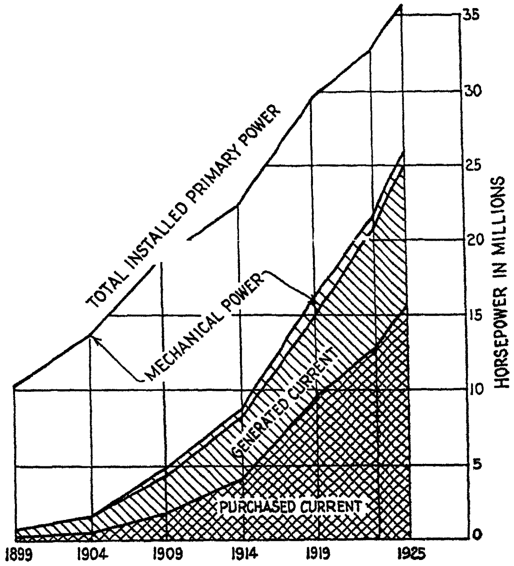
CHART 9—POWER SUPPLIED BY FOUR KINDS OF PRIME MOVERS



kind, however, overlooks the fact that much steam is required for processing, and this service cannot, in general, be supplied by the central station.

However, the increase in purchased power from 9,284,499 horse power in 1919 to 15,868,828 horse power in 1925 is not only impressive but is indicative of the rate of growth. The effect of this change upon production and productivity cannot be determined. However, electric power is making industry more mobile as regards location and is probably contributing to a reduction in prime cost.

CHART 10.—RELATIONSHIP BETWEEN MECHANICAL AND ELECTRIC POWER IN MANUFACTURING INDUSTRIES



6. Power Machinery.—Unfortunately, not much can be said in regard to changes in efficiency as regards the prime movers in use in manufacturing plants. Where new power plants are installed they make use of the most efficient equipment available. But many plants are old and are operating under disadvantageous conditions with generally low efficiencies.

As to industrial power plants generating energy for the use of the owners only and not selling to the public, the reciprocating steam engine, once used almost exclusively, is rapidly becoming obsolete. It is still found in use in old concerns where such machines have been in service for years, and in plants and factories where large quantities of process steam are needed, such as paper mills, chemical manufacturing plants, and laundries. The same reasoning also applies to large buildings that have to be heated in winter and at the same time use power, and which are so located that, all things considered, purchased power proves to be too expensive; in such circumstances there must be independent generation of process or heating steam, or both. In other words, it is still good economy to "use an engine as a reducing valve," especially when the engine is already there and in good mechanical condition. Such new reciprocating engines as are in use are generally of the uniflow type; as this engine gives the economy of the compound engine, yet has only one cylinder and set of reciprocating parts. As to the economy of steam power in the average industrial field, figures mean little or nothing, on account of the huge demand for industrial or processing steam.

For certain large industrial establishments where considerable process steam and power are needed, the tendency is toward higher boiler pressure with steam turbines as reducing valves, even with steam mains at more than one pressure intermediate of the boiler, as a maximum, and the lowest process pressure, which is the back pressure of the last turbine, as a minimum. One large plant recently installed 400-pound pressure boilers with turbines exhausting against 125 pounds process pressure, and another new plant is being built using 1,200 pounds boiler pressure and process steam at 200 pounds.

Where process steam is not the determining factor, and the demand is merely for mechanical power, the choice usually lies between either purchasing from a steam or hydroelectric central station distributing system, or using oil engines. And when considerations other than that of available power determine the location of a manufacturing plant, so that it is completely out of reach of the power lines of a central station, the oil engine is in high favor. These, of course, are normally the smaller plants. The oil engine has also a practical monopoly on the smaller central stations, supplying light and power to towns and villages located far from the transmission lines of large steam or hydroelectric central stations.

It is worth noting, in this connection, that the so-called "semi-Diesel" engine has been about driven from the field by the true Diesel. The solid injection type is used up to a certain output capacity, and the compressed-air atomizing type for larger capacities. Even comparatively small Diesel units now operate steadily on 0.5 pound of oil per horsepower-hour, and are remarkably dependable and fool-proof. Diesel engines are also being installed as stand-bys in many hydroelectric central stations, and even in a number of manufacturing plants using purchased electric power, where certain processes are carried on that would involve the company in serious financial loss if there were any interruption in the power supply.

Central Station Efficiencies.—The record of central station power is quite different, for facts are available to show the steady progress which has been made in decreasing the consumption of fuel per kilowatt-hour generated. Table 10 shows this change from 1919 to date, during which period the remarkable improvement has occurred of reducing the consumption of fuel to 55 per cent of what it was in 1919 per unit of electrical energy generated. During this same period the output of energy has more than doubled, the figures, in millions of kilowatt-hours, being as shown in the following statement:

1919	24,315	1924	39,044
1920	27,405	1925	43,514
1921	26,005	1926	47,602
1922	30,453	1927	50,330
1923	36,327	1928	51,103

TABLE 10.—CONSUMPTION OF FUEL BY ELECTRIC POWER PLANTS

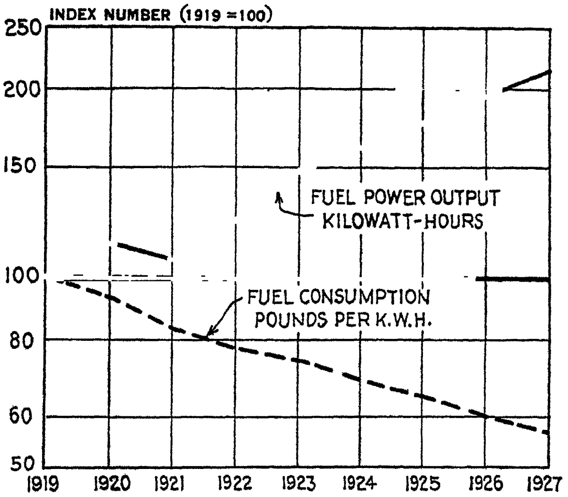
Year	Coal (short tons)	Fuel oil (barrels)	Gas (thousand cubic feet)	Total coal equivalent (short tons)	Pounds of coal per kilowatt-hour generated	Per cent of 1919
1919	35,100,000	11,050,000	21,406,000	38,880,000	3.20	100
1920	37,124,000	13,123,000	24,706,000	41,420,000	3.02	94
1921	31,585,000	12,045,000	23,722,000	35,240,000	2.70	84
1922	34,179,000	13,197,000	27,172,000	38,000,000	2.49	78
1923	38,954,000	14,679,000	31,433,000	43,522,000	2.40	75
1924	37,556,000	16,630,000	48,443,000	43,130,000	2.21	69
1925	40,222,000	10,246,000	46,621,000	44,780,000	2.06	66
1926[a]	41,311,000	9,399,000	53,207,000	45,856,000	1.93	61
1927	41,888,000	6,782,000	62,919,000	45,910,000	1.84	57
1928	41,336,000	7,126,000	77,174,000	46,434,000	1.76	55

[a] Table includes, besides all electric light and power plants, the electric railways and certain manufacturing establishments which contribute all or a portion of their output to the public supply.

Source: United States Geological Survey.

Chart 11 shows the relationship between this decrease in fuel consumption and the increase in power generated.

CHART 11.—RELATIONSHIP BETWEEN FUEL CONSUMPTION PER KILOWATT-HOUR AND TOTAL OUTPUT OF ELECTRICAL ENERGY



The advance in the design, construction, and operation of large steam central stations has been principally along three lines: (1) larger generating units using steam turbines exclusively as prime movers and larger boilers; (2) higher steam pressures and superheat temperatures; and (3) greater use of waste-heat recovery apparatus. To these might be added improvements in all auxiliary machinery, to the advantage of the over-all efficiency of operation. A rough idea of the advance in efficiency may be had from the fact that for one station, generating from 20,000 to 100,000 kilowatts, the present rate of coal consumption is about 2 pounds per kilowatt-hour as against about 3.5 pounds per kilowatt-hour 10 years ago. Heat economies have also been introduced all the way from the furnaces to the last expansion stage of the turbine.

Higher efficiencies than now obtained by the best, about 13,000 B. t. u. per kilowatt-hour, are expected and can be produced; but not a great deal higher for the best all-around results. The trend at present is rather to raise the general average of power generation all over the country than to construct occasional units of exceptional efficiency, leaving the majority of power-generating plants in their present condition.

To-day central station pressures are to be found in three ranges for modern installations: (1) a range around 400 pounds per square inch; (2) a range from 550 to 750 pounds; (3) a range from 1,000 to 1,400 pounds. The greatest activity at present is in the first and third ranges, the intermediate one being proportionately neglected. The choice between these two, the basis of selection, is partly a matter of load, but more a matter of coal prices. For a cheap coal with a small average load, the 400-pound range is preferred; with a higher priced coal and a high average load, the 1,000-pound range is preferred; both may be found in the same station. Thus, in modern existing stations, with units already in use operating at 400 pounds or less, 1,000-pound boilers can be added and high-pressure turbines can use this steam, exhausting it into the lower-pressure steam mains, after reheating for the lower-pressure turbines.

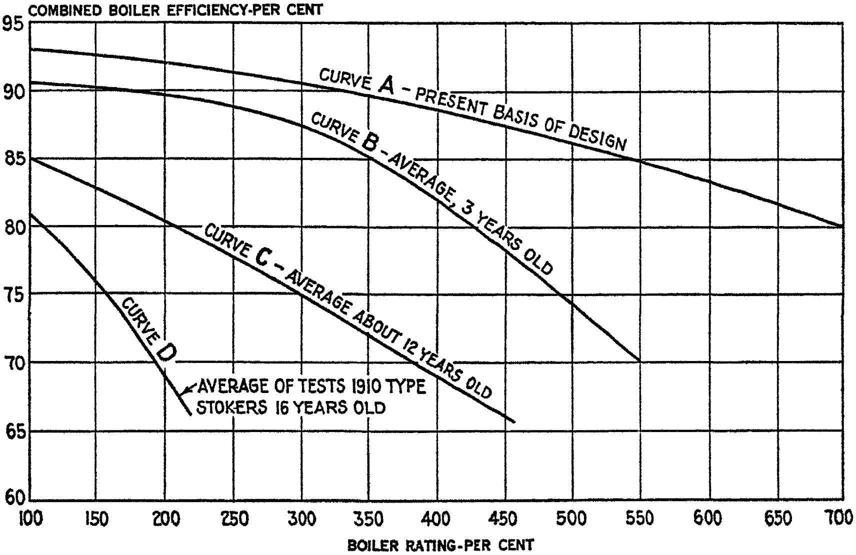
Temperatures are now limited to about 750° F. because as yet the metallurgists have not been able to provide a steel at a usable price that is perfectly reliable for higher temperature. The tendency, however, is upward, and 800° and 850° F. are already in use to a limited extent.

There is also a tendency toward larger boiler units; some in operation to-day are good for over 400,000 pounds of steam per boiler per hour. Others now under erection have a specified capacity of 1,000,000 pounds of steam per boiler per hour. It seems probable that the practice will soon be to provide each turbine with its own boiler, no matter how large the turbine.

Interconnection of stations is also extending, making it unnecessary to have both peak-load and base-load units in one and the same station, by substituting base-load stations and peak-load stations. Interconnection also improves the average load through the "diversity factor," peak loads on one part of a chain not occurring at the same time as on another part. This is noticeable in one district, for instance, where a mine and colliery load is just going off at the same time that the electric traction load of a near-by city is just rising to its peak in the early evening.

Boiler Efficiencies.—The improvement in boiler efficiencies has been toward the attainable maximum, a fair statement of the change in well-operated plants being indicated by Chart 12. This shows in curve A what may be expected of boiler and stoker performance on the basis of design, age, and from 100 to 700 per cent rating; curve B is on the basis of boilers three years old; curve C shows an average for those about 12 years old; and curve D was developed from a group of tests on stokers and boilers 16 years old.

CHART 12.—IMPROVEMENT OF BOILER EFFICIENCY IN RECENT YEARS



In fuel, the outstanding change of the past few years has been the growth of pulverized coal installations. The extent of the use of fuel in this form is indicated by the fact that at the present time 40 public utilities in the United States are either partially or fully operated with pulverized coal, the aggregate generator capacity so fired being 2,200,000 kilowatts. In addition, there are now under construction five new plants and extensions to two old plants having together a total capacity of 440,000 kilowatts, all of which will be operated with pulverized coal. The significance of these figures can better be appreciated from the following tabulation:

	Number	Capacity, kilowatts
Installations in operation	40	2,200,000
Installations under construction	7	440,000
Total	47	2,640,000
Installations in operation and under construction entirely operated with pulverized coal	27	1,700,000
Plants with 40,000 kilowatts capacity or more operated with pulverized coal	27	2,250,000

Steam Turbines.—The increase in size of steam turbine units has been mentioned. What this increase has meant in recent years in improvement in the water rate and in a few other significant factors is indicated

TABLE 11.—STEAM TURBINE DEVELOPMENT, 1918–1928

(Westinghouse Electric & Manufacturing Co.)

	1918–1920	1921–1924	1925–1926	1927–1928
Largest single-cylinder turbine built	25,000 kilowatts	30,000 kilowatts	40,000 kilowatts	60,000 kilowatts
Best point water rate (straight condensing)	12.46 lbs./kilowatt-hours	10.24 lbs /kilowatt-hours	10 22 lbs /kilowatt-hours	9 16 lbs /kilowatt-hours
Steam conditions	185 lbs –125° S–28½″	265 lbs.–214° S–29″	260 lbs –214° S–29″	290 lbs –700° TT–29¼″
Normal speed	1,500 R P.M.	1,800 R.P M	1,800 R P.M	1,800 R P.M.
Largest compound turbine built	60,000 kilowatts	62,000 kilowatts	104,000 kilowatts	165,000 kilowatts
Number of cylinders	3	3	3	2.
Best point water rate (straight condensing)	10 58 lbs /kilowatt-hours	7.56 lbs /kilowatt-hours	7.97 lbs /kilowatt-hours	9 12 lbs./kilowatt-hours
Steam conditions	265 lbs.–175° S–29″	550 lbs –725° TT–29″ Reheated between HP and IP to 700°F.	550 lbs –725° TT–29″ Reheated between HP and IP to 500°F.	265 lbs.–290° S–29″
Normal speed	H P–1,800 R.P M Ea. LP–1,200 R.P.M	1,800 R P M	1,800 R.P.M.	1,800 R.P M
Other compound turbines built	..	50,000 kilowatts	80,000 kilowatts	110,000 kilowatts.
Number of cylinders	..	2	2	2.
Best point water rate (straight condensing)	..	10.10 lbs /kilowatt-hours	9.05 lbs./kilowatt-hours	8.74 lbs./kilowatt-hours.
Steam conditions	..	265 lbs.–200° S–29″	375 lbs –258° S–27½″	400 lbs.–258° S–29″
Normal speed	..	1,200 R.P M.	1,800 R P M	1,800 R.P M.
Approximate weight per kilowatt rating	42.5 lbs	34.3 lbs.	23.2 lbs.	14.9 lbs.
Approximate floor space per 1,000 kilowatt of rating	59 sq ft	39.6 sq. ft.	34 sq ft	16 sq. ft.

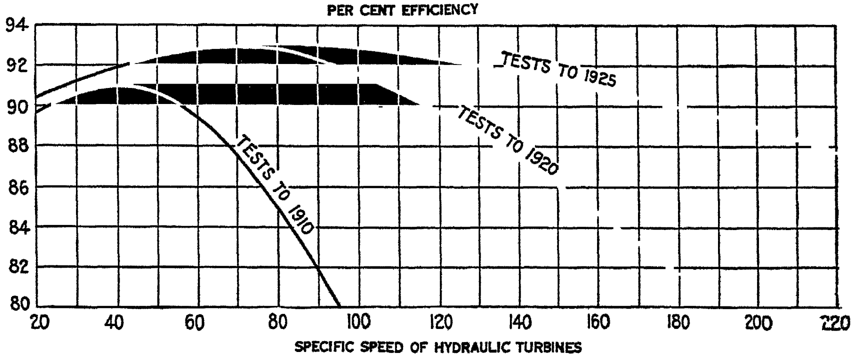
by Table 11, which is from the practice of the Westinghouse Electric & Manufacturing Co.

Diesel Engine Efficiencies.—The Diesel engine is the only mechanical prime mover which has increased in number of horse power applied in manufacturing plants since 1919. The reason for this is undoubtedly because it is the most efficient converter of heat energy and fuel into mechanical power. Its thermal efficiency is approximately 33 per cent, and this is true even in units as small as 50 horse power. The ratio of useful energy can be considerably increased in certain cases by the utilization of the waste heat in exhaust heaters, boilers, and exhaust turbines.

Recent changes in Diesel engine construction have substantially reduced the weight per horse power, have slightly reduced the first cost per horse power, and have slightly reduced the fuel consumption.

Hydraulic Turbines.—Recent improvements in the design and construction of hydraulic turbines have increased the efficiencies, particularly at higher specific speeds. Chart 13, from a paper presented by George A. Jessop, chief engineer, S. Morgan Smith Co., to the American Society of Civil Engineers in 1925, gives the relation of efficiency to specific speed based on test models of Holyoke size for three years, 1910, 1920, and 1925. He has extended this information to date as given by the following comparison:

CHART 13.—INFLUENCE OF IMPROVEMENTS IN HYDRAULIC TURBINES ON THEIR EFFICIENCIES AT VARIOUS SPEEDS



Year	Specific speed	Percentage efficiency
1910	40	91.0
1920	70	93.0
1925	80	93.1
1926	45	94.0
1928	78	93.7

7. Industrial Buildings.—It has seemed advisable to extend the figures for industrial buildings through 1927.[8]

A study by Professors Charles W. Cobb and Paul H. Douglas gives values of manufacturing buildings for census years, from 1899 to 1919, and for the subsequent year 1922. These economists also give a cost index for this same period based upon those commodities which are most important in construction work, namely, pig iron, rolled and forged steel, lumber, coke, cement, bricks, and copper.[9] The United States Department of Commerce gives industrial buildings contracted for in square feet of floor space, year by year, from 1915 to 1926, inclusive. The statistics are for the 27 most important industrial states and are estimated to be 75 per cent of the construction for the United States as a whole. Increasing these figures to give a total estimate, yields the figures given in the following statement:

1915	85,300,000	1921	48,000,000
1916	129,300,000	1922	88,000,000
1917	145,300,000	1923	82,600,000
1918	241,300,000	1924	54,600,000
1919	204,000,000	1925	78,600,000
1920	170,600,000	1926	90,600,000

The unit value per square foot in dollars, added in the Cobb-Douglas statement for the period 1919 to 1922, was computed by dividing the total increase in dollars by the number of square feet contracted for in the years 1918, 1919, 1920, and 1921. This factor was then multiplied by the number of square feet in the preceding table, and the resulting sum in dollars was added as the increment for the succeeding year. That is, to the total estimated dollar value of industrial buildings for 1922 was added the sum obtained by multiplying the number of square feet contracted for 1921 by the average square foot value. This process yielded the estimated value of industrial buildings, 1899 to 1927 (1899 base year), as shown in the following statement:

Year	Value	Index number	Year	Value	Index number
1899	$1,450,000,000	100	1923	$4,481,000,000	309
1904	2,036,000,000	140	1924	4,566,800,000	316
1909	2,704.000,000	187	1925	4,689.600,000	323
1914	3,238,000,000	223	1926	4,864,000,000	336
1919	3,285,000,000	226	1927	5,066,000,000	350
1922	4,283,000,000	295			

It should be explained that the total values from 1899 through 1922 had been corrected for the change in dollar value during that period, that they may reflect the physical changes in industrial buildings. No correction is possible, however, for industrial buildings that may have been abandoned and destroyed for various reasons, or for construction work carried on without the letting of contracts. Inasmuch as the purpose of this investigation is to indicate a trend rather than actual values, it may be assumed that these two factors substantially offset one another.

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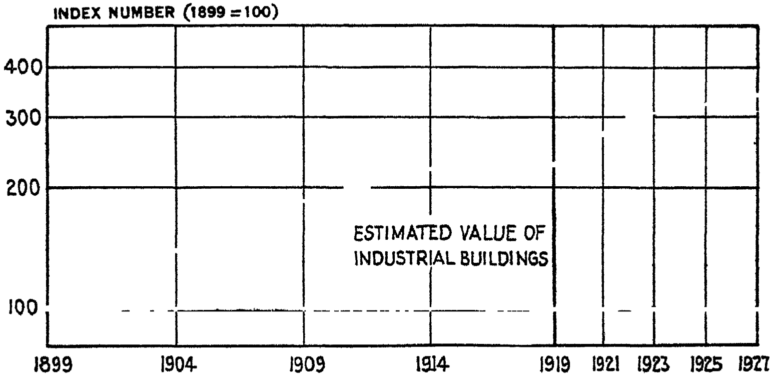
[8] This can be done provided one assumption is accepted, namely that the square footage of industrial buildings contracted for in any one year does not, on the average, go into use and become productive until a year later.

[9] *American Economic Review*, Supplement, March, 1928.

The values given in the immediately preceding tabulation, reduced to index numbers with 1899 as the base, are plotted in Chart 14. The construction of this curve shows that, following a sharp rise in the addition of industrial buildings between 1919 and 1922, the rate of addition has become much less, in fact the curve is flat. The construction of industrial buildings is thus seen to have been less active, and the increase in this production factor has had less influence on manufacturing operations since 1922 than immediately before that date.

CHART 14.—INDEX OF VALUE OF INDUSTRIAL BUILDINGS, 1899–1927

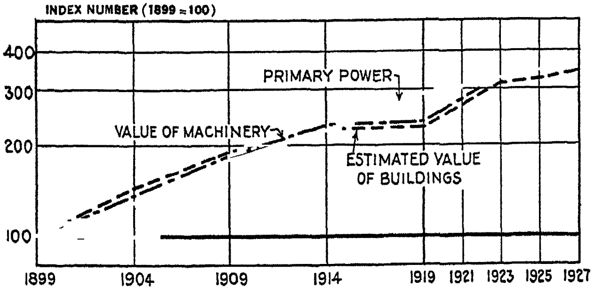


8. Manufacturing Machinery.—Manufacturing machinery is one of the production factors that were shown in the first section of this chapter to have had a marked change in amount following 1919, and presumably as having had a major influence upon the increase of productivity per man-hour which exhibited itself following 1921. All of the available data on such machinery are there presented. However, certain other relationships are worthy of presentation here.

Examination of trend curves shows that from 1899 to 1919 the curve of machinery, in so far as it can be plotted, lies coincident with the curves for primary power and industrial buildings. From 1914 to 1922 it lies between these two curves, but somewhat closer to the one for industrial buildings. In the immediately preceding pages, the curve for industrial buildings has been extended through 1927. Chart 15 places in comparison three curves: primary power, 1899–1925; industrial buildings, 1899–1927; manufacturing machinery, 1899–1922.

If it can be assumed that the curve for machinery continues to lie between the one for primary power and the one for industrial buildings, its position is approximately located on the chart.

CHART 15.—THE INCREASE IN VALUE OF MANUFACTURING MACHINERY AS COMPARED WITH PRIMARY POWER AND INDUSTRIAL BUILDINGS



There are several reasons which lead to the belief that the increase in manufacturing machinery approximates, though perhaps at slightly higher levels, the increase in industrial power. The demand for higher speeds, greater output, and lower-cost production, has tended to increase the size and weight of manufacturing machinery and horse power required to drive it per machine. While this tendency has exhibited itself in regard to machinery, the pressure for lower costs has tended to increase the effectiveness with which the floor area of industrial buildings is used. Thus, machines are being concentrated with only sufficient surrounding space to store material in process and only sufficient aisle width to care properly for the various services that must be rendered in any producing department. The trend of technical discussion to-day in regard to industrial buildings is how to increase effectiveness of manufacturing floor areas; that is, how, per thousand square feet, to install more machines, and increase employees and production. The influence of these elements of improvement would tend to increase the amount of machinery installed per unit of floor area and, turning back to Chart 15, would tend to lift the curve for machinery somewhat above that for buildings.

Another indication of this change is found in the horse-power curve which tends to rise more rapidly than the curve for industrial buildings, indicating that primary power per unit of floor area is tending to increase.

During the postwar period a change has come in the basis upon which new manufacturing machinery is installed, either as additional to plant or as replacement for old and less efficient equipment. The attitude toward all new manufacturing equipment is expressed by these questions:

> Will it improve the quality of our product?
> Will it improve our service in the filling of customers' orders?
> Will it reduce cost?

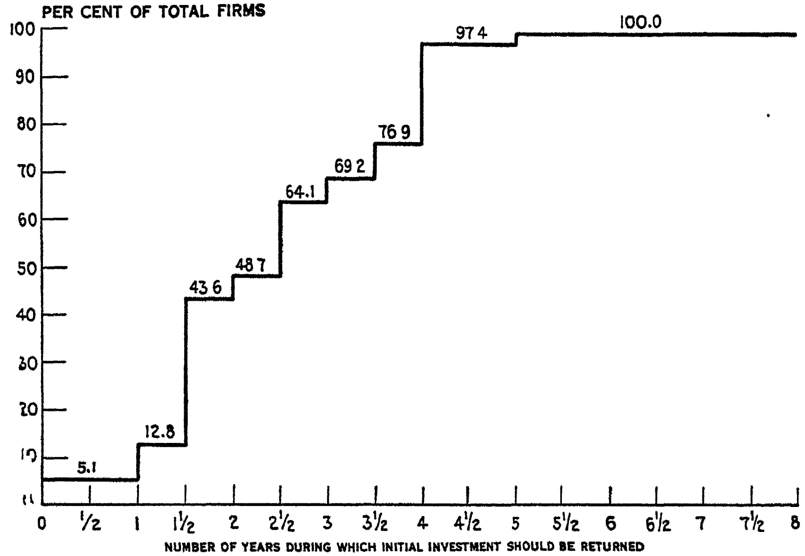
A questionnaire sent to 800 of the larger and more representative manufacturing concerns of the United States sought to disclose the policy pursued when purchasing new equipment. The question bearing upon this point read:

> Has your company a policy against the purchase of new equipment unless the production savings will return the initial investment within a definite period? If so, what is this period?

Nearly 200 replies were received to this questionnaire, disclosing that 43.6 per cent of the companies required that new equipment should return its cost through savings in a period of two years or less, and that 64.1 per cent required that it should pay for itself in three years or less.

Chart 16 shows the relationship between the number of years during which the initial investment must be returned and the percentage of firms requiring the return in that period or in a shorter time.

CHART 16 —POLICY OF MANUFACTURING FIRMS IN REGARD TO THE PURCHASE OF NEW EQUIPMENT



The existence of a policy of this kind indicates the nature of the technical efforts being put forth not only to improve the capacity of manufacturing machinery, but also to increase its economy. Without doubt this is a most important element in the cost-reduction program of 1919 to date.

9. Material-handling Equipment.—*Fifty Typical Installations.*—The lessening of the supply of crude laborers owing to the restriction of immigration, reduction of working hours in certain industries, and the greatly increased cost of unskilled labor, have compelled the installation of machinery and equipment to do work formerly performed by muscular effort.

TABLE 12.—FIFTY TYPICAL INSTALLATIONS OF MATERIAL-HANDLING EQUIPMENT

Material or product handled	Equipment used	Plant	Savings and improvements
AUTOMOBILES AND ACCESSORIES			
Cylinder blocks	Standard conveyors	Nash Motor Co	$8,600 per year.
Annealing pots	Tier-lift trucks	New Departure Mfg Co	$10,800 per year
BUILDING MATERIAL			
Materials	Overhead carrying system	Architectural Tile Co	$5,000 per year
Cement materials	2 hoists	Crex Patent Column Co	$6,000 per year.
Sand and gravel	Portable conveyor and loader	Crume Brick Co	$3,900 per year
Lumber on trailers and switching cars	Tructractor	M B Farrin Lumber Co	$4,650 per year, congestion eliminated, 15 horses eliminated, 70 per cent return on investment
Building material	Locomotive crane	Dwight P Robinson Co	$18,000 in six weeks
Lumber	Locomotive crane	St Helena Dock & Terminal Co	$41,000 per year
Crushed stone	Belt conveyor	Leathem D Smith Stone Co	Doubled capacity
FOOD			
Sugar	Automatic packing and handling equipment.	American Sugar Refining Co	One-half of labor
Coal and ashes.	Bucket conveyor	George Ehret Brewery Co	Equipment handles 20,000 tons of coal per year at 9 cents per ton including maintenance and repair charges
Coal	Conveyor	Freeman Dairy Co	$0 98 per ton, $2,500 per year
Sugar packed in cartons	Conveyors	National Sugar Refining Co	$8,800 per year
Candy in boxes and cartons	Gravity conveyors and spiral chutes	Samoset Chocolate Co	$3,370 per year
Materials	Overhead trackway connecting all departments.	Swift & Co	$125,000 per year, $0 60 per ton material handled
FOUNDRY			
Cupola charges	Hoist	Davis & Thomas Co	$5,850
Castings	Belt conveyors	Kelsey Wheel Co	$10,000 per year
Materials	3 tructractors	Southside Malleable Castings Co	$22,500 per year.
Castings	Tructractors	Standard Sanitary Mfg Co	Annual savings 17 times cost of equipment.
IRON AND STEEL			
Iron and steel	2 tructractors	American Radiator Co	$22,000 per year, $1 345 per ton
Steel, machinery, forgings	2 locomotive cranes	E W Bliss Co	Equipment pays for itself each year
Iron and steel.	15-ton locomotive crane	Delaware River Steel Co	$10,300 per year
Rails	Locomotive crane	McKenna Process Co	Doubles production
Steel (on buggies)	Tructractor	Riter-Conley Mfg Co	$2,960 per year, saves $8,000 in increased production, labor turnover reduced, pays for itself in about 54 days
Iron and steel scrap.	Locomotive crane	Sonken-Galamba Iron and Metal Co	$30,000 to $40,000 per year, big saving in time
LEATHER			
Fleshings	Tractor	Joseph Eisendrath Co	$3,400 per year
Patent leather in frames	Overhead carrying system	Greiss-Pfleger Tanning Co	$5,000 per year
MACHINERY			
Shipping cases	Gravity chute.	General Electric Bloomfield Plant	$6,000 per year, rapid loading of cars.
Castings and foundry supplies	4 tructractors and trailers.	Holt Mfg Co	$13,300 per year
Materials	3 cranes	Reliance Electric & Engineering Co	$9,350 per year

METAL WORKING			
Materials	Complete conveyor system	Belden Mfg Co	Yearly profit $12,450 on investment of $19,611
Materials	2 tructractors	Bullard Machine & Tool Co	$10,500 per year
Assembling stoves	Conveyor	Detroit Vapor Stove Co	Increases production, saves 50 per cent of space
Materials	Roller and belt conveyor	Hobart Bros Co	Cut production cost 25 per cent
Dies	Tier-lift truck	Ireland & Matthews Drop Forging Co	$32,000 per year.
Materials and product.	3 elevating conveyors	Tin Decorating Co	$47,400 per year
Materials	Overhead carrying system	United Metal Co	$7,500 per year
Coal, coke, ores, and slag	Locomotive crane	United States Metals Refining Co	Increased production 100 per cent
Materials	Stationary roller conveyors and containers.	Walworth Co	$60,000 per year
PAPER			
Paper	Skids for loading box cars	Champion Coated Paper Co	Reduction in labor 93 per cent
Paper.	Electric hoist	Paper Manufacturers Co , Inc	Increased production on one process 66 per cent
Paper in rolls to cutting machines	5 hoists	Paterson Parchment Paper Co	$4,100 per year
Paper and paper stock	Nailed wooden skids for shipping	West Virginia Paper and Pulp Co	Reduction in shipping material cost 77 per cent, reduction in labor in handling shipments, 80 per cent.
TEXTILES			
Materials	Complete conveyor system for mill	Jackson Mills	$16,250 per year, successful material control and improvement in machine operations
Raw cotton	Pneumatic conveyor	Milstead Mfg Co	$1,600 per year.
MISCELLANEOUS			
Lumber and materials	Miscellaneous handling equipment	American Seating Co	Reduced handling cost per man-hour from 17 to 9 cents, annual saving, $95,000, additional saving over handling improvement about $25,000 per year.
Materials	Conveyor system for entire plant	B T Babbitt Co	Unloading costs $0 02 per box for metal cans, $0 02 per drum for caustic soda, $0 04 per drum for line, $0 50 per thousand for fiber boxes, $1 50 per thousand for wooden boxes, shipping cost $0 0075 per package
Flaxseed from ship to storage to mill	Conveyor and elevating system	Bisbee Linseed Co	$15,000 per year
Clay	Tructractor	Champion Porcelain Co	$8,400 per year
Materials and products	Complete system of conveyors, elevators, lift trucks, spiral chutes, and gravity devices	E R. Squibb Co	Elimination of unnecessary travel of material in process and finished product

Two beneficial results have been secured: (1) a reduction in the cost of moving and transporting materials and product; (2) an increase in production, for the new machinery in many cases has set the pace of the production process.

Table 12 gives information on 50 typical installations of material-handling equipment. For each item the material or product handled is indicated, the kind of machinery installed is designated, the plant where the installation was made is named, and the savings or improvements are given. For 37 of these installations the savings aggregate over $850,000 per annum. For many of these and for most of the other 13, the statement is made that production has increased.

Large as the money saving is, it is probable that the improvement in production, reflected in increased productivity of the worker and lower manufacturing costs, is of even greater significance. In fact, the control of production which is being secured through the aid of modern material-handling machinery is probably the greatest single improvement which has come in the technical operation of manufacturing establishments since 1919.[10]

10. Mechanical Safeguards for Plant and Machinery.—Changes which affect health, comfort, and well-being in working are known to have an influence upon production and productivity. The degree of their influence is difficult to measure and the improvement represented by the best practice to-day has been recognized for a number of years. In fact, it is doubtful if any plant constructed during the later war period and since has not been reasonably up-to-date in regard to all such features.

Included in the facilities which contribute to working conditions are safeguards, artificial illumination, heating, ventilation, provisions for removing fumes and dust, provisions for medical and dental attention, and facilities for serving food. Of these, only two are subject to quantitative determination in regard to the position they occupy in American industry to-day. Most of them are subject to some regulation under state factory laws, and are inspected to assure at least minimum compliance. Two of these, safety and illumination, are capable of study to show the nature of recent changes.

Within a year the American Engineering Council has completed an extensive investigation to determine the relationships that exist between safety and production. The investigation comprised some 14,000 plants, about 2,500,000 workers, and over 54,000,000,000 man-hours.

It was shown that the coefficient of correlation between safety and production, that is, of those cases where productivity had increased at the same time that accidents had been reduced, was 0.835. That is, the manufacturing plant with high productivity may be expected to have a low accident rate and vice versa.

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[10] The information in Table 12 is from two sources: the replies to the questionnaire sent out on behalf of the Survey, and library research in current engineering and technical publications. All of the installations have been reported upon since 1924, and have been in operation since 1920.

W. H. Heinrich, assistant superintendent of inspection, Travelers' Insurance Co , has recently made a determination of the percentage of industrial accidents due to physical causes. His study comprised 73,000 cases where the records were available either in the files of his own company or in those of manufacturing concerns. His conclusion is that the lack of mechanical safeguards is to-day a comparatively minor cause factor in industrial accidents, for he attributes to all physical causes only 10 per cent of all the accidents which occur. Two per cent are unavoidable, and the other 88 per cent are due to managerial and supervisory fault. This may be taken as an indication that the safeguarding of machinery in the plants which yielded the 73,000 cases studied had been carried to a reasonable degree of excellence.

11. Artificial Illumination.—The changes which have taken place in provisions for industrial lighting during the past decade have been particularly noteworthy. Intensities have increased, for it has been shown that such improvements have a direct beneficial effect upon production.

Table 13 shows the progressive increase in intensities which have taken place from 1915 to date, as represented by adopted lighting codes and by good practice. Table 14 shows, for a group of representative manufacturing operations, actual increases which have taken place in intensities and the resulting improvement in production. An interesting fact displayed by this table is that the intensities actually used range somewhat higher than the maximum recommended in the codes of Table 13.

TABLE 13.—ARTIFICIAL ILLUMINATION CODES FOR FACTORIES, 1915 TO 1928, INCLUSIVE

(In foot-candles)

Operation or industry	Illuminating Engineering Society, 1915[a]	Illuminating Engineering Society, 1917[a]	Natl Elec Light Association, 1921[b]	Illuminating Engineering Society, 1923[a]	Edison Lamp Works, 1926[c]	Westinghouse Lamp Co., 1928[d]
Assembling						
Rough	1 25–2 50	2–4	3–6	2–5	3–6	5–8
Medium	.		4–8	5–10	5–10	8–12
Fine			6–12	5–10	8–16	12–20
Chemical works						
Hand furnaces, boiling tanks, stationary driers, stationary or gravity crystallizing			2–4	2–5	2–4	3–5
Mechanical furnaces, generators and stills, mechanical driers, evaporators, filtration, mechanical crystallizing, bleaching			3–6	2–5	3–6	4–6
Tanks for cooling, extractors, percolators, nitrators, electrolytic cells			4–8	5–10	4–8	6–10
Engraving	10–15	10–15	8–16	10–20	10–50	25–50–100
Foundries:						
Charging floor, tumbling, cleaning, pouring, and shaking out	1 25–2 50	2–4	2–4	2–5	3–6	5–8
Rough molding and core-making	.	.. .	3–6	.	4–8	6–10
Fine molding and core-making	.	.	5–10	5–10	6–12	10–15
Glass works:						
Mix and furnace rooms, casting and Lehr			3–6	2–5	4–8	6–10
Grinding, glass blowing machines, cutting glass to size, silvering	..		4–8	5–10	5–10	8–12
Fine grinding, polishing, beveling, inspecting, etching and decorating	.		6–12	5–10	6–12	10–15
Glass cutting (cut glass), fine inspection			.. .	10–20	10–50	15–25–50
Inspecting						
Rough	.		3–6	5–10	4–8	6–10
Medium	.	.	5–10	5–10	6–12	10–15
Fine			8–16	10–20	10–20	15–25
Jewelry and watch manufacturing	10–15	10–15	8–16	10–20	10–50	25–50–100
Leather manufacturing:						
Vats	. .	.	2–4	2–5	2–4	3–5
Cleaning, tanning and stretching	.		3–6	2–5	3–6	4–6
Cutting, fleshing, stuffing	.		4–8	5–10	4–8	6–10
Finishing and scarfing	. .		6–12	5–10	6–12	10–15
Machine shops:						
Rough machining and rough bench work	1 25–2 50	2–4	3–6	2–5	4–8	6–10
Medium bench and machine work, ordinary automatic machinery, rough grinding, medium buffing and polishing	....	3–6	5–10	5–10	6–12	10–15
Fine bench and machine work, fine automatic machinery, medium grinding, fine buffing and polishing	3 50–6 00	4–8	8–16	10–20	8–16	12–20
Paint shops:						
Dipping, spraying, firing	. ....	......	3–6	2–5	3–6	5–8
Rubbing, ordinary hand painting and finishing	. .	. .	4–8	5–10	5–10	8–12
Fine hand painting and finishing	.. .	. .	6–12	5–10	8–16	10–15

Extra fine hand painting and finishing (automobile bodies, pianos, etc.)	...	...	8–16	10–20	10–50	25–50–100
Paper manufacturing:						
Beaters, machine grinding	...	...	3–6	2–5	3–6	4–6
Calendering	...		4–8	5–10	4–8	6–10
Finishing, cutting and trimming	...		6–12	5–10	6–12	8–12
Roadways and yard thoroughfares	...	0.05–0.25	0.05–0.25	0.05–0.25	0.25–1.00	
Rubber manufacturing and products						
Calenders, compounding mills, fabric preparation, stock cutting, tubing machines, solid tire operations, mechanical goods building, vulcanizing	...	...	4–8	5–10	5–10	8–12
Bead building, pneumatic tire building and finishing, inner tube operations, mechanical goods trimming, treading		...	5–10	5–10	6–12	10–15
Stairways, passages and aisles (except exits and passages leading thereto)	0.25–0.50	0.75–2.00	1–2	1–2	1–2	2–3
Steel and iron mills—bar, sheet and wire products						
Soaking pits and reheating furnaces	...	...	1–2	2–5	1–3	2–3
Charging and casting floors	...	...	2–4	2–5	3–6	4–6
Muck and heavy rolling, shearing (rough by gauge), pickling and cleaning	...	...	3–6	2–5	3–6	5–8
Automatic machines, rod light and cold rolling, wire drawing, shearing, fine by line	...		4–8	5–10	5–10	8–12
Textile mills:						
Light goods	3.5–6	4–8	4–12	5–10	4–10	6–15
Dark goods	10–15	10–15	6–16	10–20	8–20	10–20
Woodworking:						
Rough sawing and bench work		...	3–6	2–5	3–6	5–8
Sizing, planing, rough sanding, medium machine and bench work, gluing, veneering, cooperage	...	...	4–8	5–10	5–10	8–12
Fine bench and machine work, fine sanding and finishing	...	...	6–12	5–10	6–12	10–15

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[a] *Lighting Codes*, Illuminating Engineering Society, 1915, 1917, and 1923

[b] *Industrial Lighting*, published by Commercial National Section, National Electric Light Association, 1921

[c] *Bulletin* LD-117C, "Calculation of the Lighting Installation," Edison Lamp Works of General Electric Co., August, 1926.

[d] *Bulletin* E-108, "Design of Lighting Installations," Westinghouse Lamp Co., March, 1928

TABLE 14.—INSTALLATIONS OF ARTIFICIAL LIGHTING EQUIPMENT AND CORRESPONDING INCREASE IN PRODUCTION

Operation	Average intensity old system	Average intensity new system	Per cent increase in production	Name	Address	Business
	Foot-candles	*Foot-candles*				
Carburetor assembly	2.1	12.3	12.0			
Dispatching division	3.3	7.6	12.5	Post Office		Letter separating
Final sorting	3.3	5.9	20.0	Post Office		Letter separating
Grinding and machine work	1.2	6.5	13.0	Detroit Piston Ring Co	Detroit, Mich	Piston ring manufacturing
Grinding and machine work	..	9.0	17.9	Detroit Piston Ring Co	Detroit, Mich	Piston ring manufacturing
Grinding and machine work		14.0	25.8	Detroit Piston Ring Co	Detroit, Mich	Piston ring manufacturing
Heavy steel machine shop	3.0	11.5	10.0			
Inspecting	43.0	55.0	42.0	American Pile Fabric Co	Philadelphia, Pa	Plush manufacturing
Inspecting	5.0	6.0	4.0	Timken Roller Bearing Co	Canton, Ohio	Roller bearing manufacturing.
Inspecting	.	13.0	8.0	Timken Roller Bearing Co	Canton, Ohio	Roller bearing manufacturing
Inspecting	.	20.0	12.5	Timken Roller Bearing Co	Canton, Ohio	Roller bearing manufacturing
Knitting	6.2	17.0	6.3	Reid Hosiery	Philadelphia, Pa	Hosiery manufacturing
Knitting.	4.5	17.2	10.8	Philadelphia Sweater Mills	Philadelphia, Pa	Necktie manufacturing
Knitting (day)	..	17.3	3.9	Realart Silk Hosiery	Philadelphia, Pa	Hosiery manufacturing.
Knitting (night)	7.2	17.3	5.75	Realart Silk Hosiery	Philadelphia, Pa	Hosiery manufacturing
Loom	10.0	13.0	15.0	American Pile Fabric Co	Philadelphia, Pa	Plush manufacturing
Loom	3.3	10.0	16.0	Shenn Manufacturing Co.	Philadelphia, Pa	Towel and wash rag manufacturing.
Loom	6.8	7.9	7.7	John Sidebotham	Philadelphia, Pa	Tape manufacturing
Loom	..	15.5	11.1	John Sidebotham	Philadelphia, Pa	Tape manufacturing
Loom (day)	1.9	3.7	1.85	M. J. Smith Belting Co	Philadelphia, Pa	Belting manufacturing
Loom (day)	.	4.74	2.18	M. J. Smith Belting Co	Philadelphia, Pa	Belting manufacturing
Loom (day)	..	9.66	3.22	M. J. Smith Belting Co	Philadelphia, Pa	Belting manufacturing
Loom (night)	..	3.7	13.95	M. J. Smith Belting Co	Philadelphia, Pa	Belting manufacturing
Loom (night)	...	4.74	16.75	M. J. Smith Belting Co	Philadelphia, Pa	Belting manufacturing
Loom (night)	.	9.60	19.8	M. J. Smith Belting Co	Philadelphia, Pa	Belting manufacturing
Loom	1.8	8.8	25.0	Taylor Brothers	Philadelphia, Pa	Cotton dress goods
Machine shop	3.4	8.7	3.0	D. B. Flower	Philadelphia, Pa	Brass machine shop
Metal shop	3.3	15.0	18.1	Decorative Lamp & Shade Co	Philadelphia, Pa	Lamp and shade manufacturing
Pulley finishing	0.2	4.8	35.0			Pulley shop
Soft metal bearing	4.6	12.7	15.0			Metal bearing
Splicing	4.7	27.5	7.8	Matell Mills	Philadelphia, Pa	Cotton spinning.
Turret lathes	11.6	20.0	12.35	American Metal Works	Philadelphia, Pa	Radio and electrical goods
Turret lathes	....	14.0	6.73	American Metal Works	Philadelphia, Pa	Radio and electrical goods
Turret lathes	..	7.4	2.35	American Metal Works	Philadelphia, Pa	Radio and electrical goods
Wire drawing	2.9	9.2	16.5	B. Wilmsen	Philadelphia, Pa	Christmas tree ornaments
Woodworking shop	4.5	25.0	20.9	Decorative Lamp & Shade Co	Philadelphia, Pa	Lamp and shade manufacturing
	1.5	9.0	17.0			Jute spinning
	0.7	13.5	12.2	Dover Mfg. Co.	Dover, Ohio	Manufacturing gas and sad irons

III. CHANGES IN TECHNICAL PRODUCTION FACTORS FOR 12 INDUSTRIES

Not all manufacturing product groups have progressed in keeping with the productivity and cost trends of manufacturing industry as a whole. On the other hand, there are some whose records far exceed the averages. This part of the report presents the changes in certain production factors for 12 product groups.[11]

The information for each group is presented in two ways. First, by a table of index numbers of statistical data, and, second, by a chart which plots these data. They are mainly on the 1914 base. For convenience, these product groups are divided into two classes. In the first, the increase in productivity per man-hour, over the period for which figures are available, has been more than 50 per cent. In the second, the increase in productivity has been less than 50 per cent.

This arbitrary division gives six groups in each class and brings together those industries which in general have the same operating characteristics and the same established trends. The significance of these analyses lies in their indication of those factors which, on the one hand, have changed favorably in those industries which have made the greater gain in productivity, and, on the other hand, have changed unfavorably for those that have made less satisfactory progress.

The industries of product groups showing the percentage increase in productivity are shown in the following statement:

Industries in first class:	
Automobiles	210
Rubber tires	211
Petroleum refining	77
Cement manufacture	58
Blast furnaces	54
Steel works and rolling mills	60
Industries in second class:	
Flour milling	39
Slaughtering and meat packing	27
Leather tanning	28
Cane sugar refining	27
Paper and wood pulp	26
Boots and shoes	17

Each of these product groups will be taken up separately to show significant features in the trends of the production factors. A glance at the chart for the automobile industry, Chart 17, and the one for boots and shoes, Chart 28, will make evident the great differences between a very prosperous industry and one not well-favored

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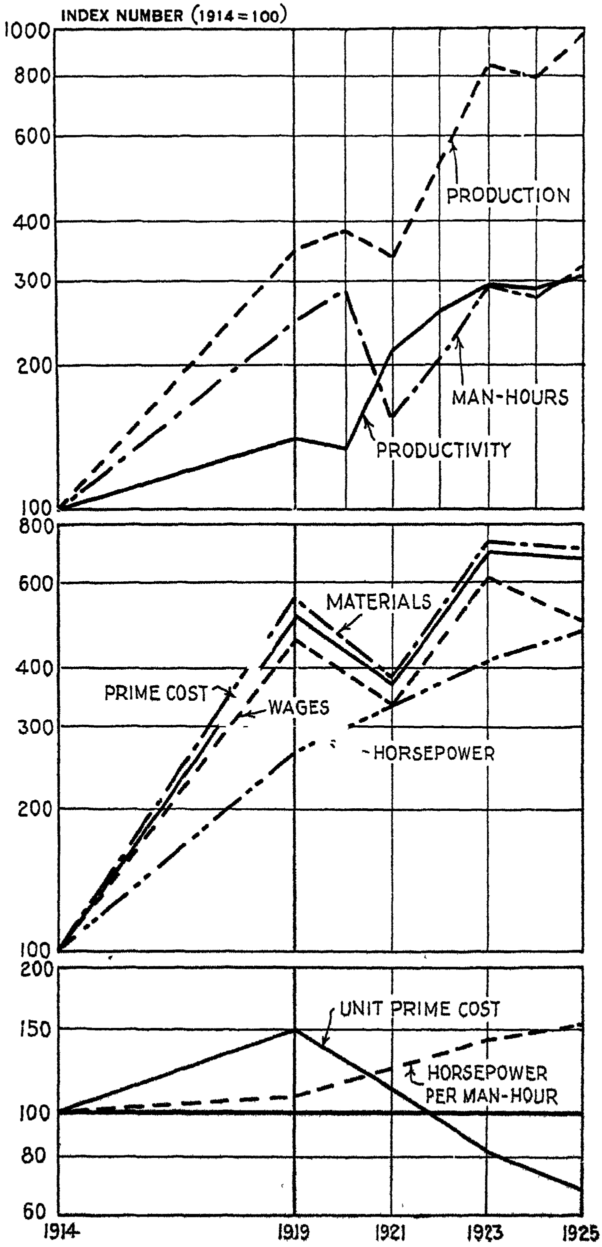
[11] Data covering these changes were secured from the following sources: *United States Census of Manufactures*, 1925, and *Monthly Labor Review*, issues for July, October, November, and December, 1926. Revised figures for three factors, production, man-hours, and productivity per man-hour, have been compiled by the United States Bureau of Labor Statistics for these 12 product groups since December, 1926, but could not be obtained in time for inclusion in this report. The index numbers used, however, show the general trend of these factors.

CHART 17.—FLUCTUATIONS OF THE PRODUCTION FACTORS OF THE AUTOMOBILE INDUSTRY



Unfortunately, two important factors, industrial buildings and manufacturing machinery, could not be included owing to the absence of data. The most that can be said in regard to them is that they have probably varied substantially in accordance with the changes in primary power.

Automobile Manufacturing.—Automobile manufacturing and the associated industry of rubber-tire building have had similar experiences since 1914. Although the increase in productivity of tire building is slightly greater than that of automobile manufacturing, the statistics for the latter are more complete and are, therefore, presented first.

The striking changes which this industry has experienced are increases in production, primary power available, and productivity per man-hour, with a decrease in unit prime cost. The index numbers for 1925 from 1914 as a base are as shown in the following statement:

Production	988
Primary power	485
Productivity	310
Unit prime cost	69

The increase in primary power, as given in Table 15, is consistent, plotting into nearly a straight line, as shown in Chart 17. All of the other principal factors change their direction markedly with the year 1919.

TABLE 15.—INDEX NUMBERS OF PRODUCTION FACTORS OF THE AUTOMOBILE INDUSTRY 1914–1925

Year	Physical production	Man-hours	Productivity per man-hour	Wages paid	Cost of materials	Prime cost	Primary power	Primary power per man-hour	Unit prime cost
1914	100	100	100	100	100	100	100	100	100
1919	353	250	141	468	540	526	270	108	149
1920	384	289	133	...	...	...	...	...	...
1921	333	155	215	331	378	370	...	...	112
1922	554	210	264	...	...	...	...	...	...
1923	870	295	295	610	735	710	416	141	82
1924	804	278	289	...	...	...	...	...	...
1925	988	319	310	510	720	681	485	152	69

Rubber Tire Building.—The changes in production factors for the industry building rubber tires and inner tubes in general show the same characteristics as those which have been presented above for automobile manufacturing. The industry has greatly increased its use of power from 1921 on, worked more man-hours, steadily improved its productivity to the equal of the automobile industry, and has reduced unit prime cost. (See Table 16 and Chart 18).

CHART 18.—FLUCTUATION OF PRODUCTION FACTORS OF THE RUBBER TIRE INDUSTRY

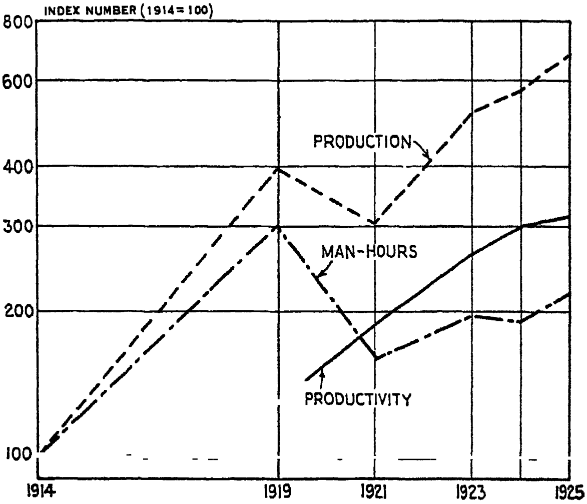


TABLE 16.—INDEX NUMBERS OF PRODUCTION FACTORS OF THE RUBBER TIRE INDUSTRY, 1914–1925

Year	Physical production	Man-hours	Productivity per man-hour
1914	100	100	100
1919	394	303	130
1921	309	163	190
1923	527	198	266
1924	580	193	301
1925	680	219	311

Petroleum Refining.—Although the over-all percentage changes in production factors in the petroleum industry are smaller than those of the automobile and tire industries (see Table 17), they present the same characteristics. Production has consistently increased since 1914. Productivity per man-hour, which decreased slightly between 1914 and 1919, consistently increased thereafter. There is no flattening of the curve, shown by Chart 19, up to 1925. Primary power utilized increased at nearly a uniform rate up to 1923 and held that level with only a slight increase up to 1925. The man-hours worked increased from 1914 to 1919, and have fluctuated but little since. The year 1919 also shows a change in direction of the curve of unit prime cost, which dropped sharply down to 1923 and then continued at a nearly uniform level.

CHART 19.—FLUCTUATIONS OF PRODUCTION FACTORS OF THE PETROLEUM REFINING INDUSTRY

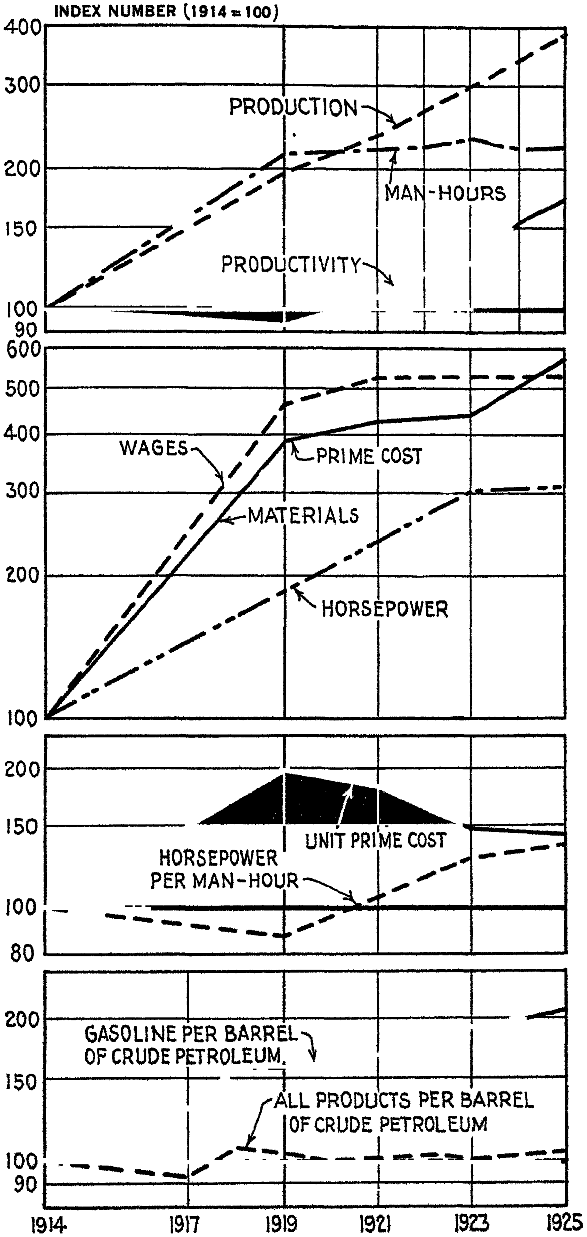


TABLE 17.—INDEX NUMBERS OF PRODUCTION FACTORS OF THE PETROLEUM REFINING INDUSTRY, 1914–1925

Year	Physical production	Man-hours	Productivity per man-hour	Wages paid	Cost of materials	Prime cost
1914	100	100	100	100	100	100
1917					.	.
1918		. .	.			
1919	197	214	92	462	384	388
1920		...	.	.		..
1921	235	217	108	530	425	430
1922	269	220	122			
1923	302	237	129	535	440	445
1924	347	220	158	..		
1925	399	225	177	540	580	580

Year	Primary power	Primary power per man-hour	Unit prime cost	Number of gallons of products per barrel of crude petroleum	Number of gallons gasoline per barrel of crude petroleum
1914	100	100	100	100	100
1917	. .			93	129
1918				106	157
1919	187	88	197	104	157
1920	...	.		100	162
1921	...	.	183	101	166
1922	. .	. .		102	177
1923	305	129	148	101	186
1924	.	. .		102	199
1925	307	137	145	103	210

The two other curves of Chart 19 show the increases in yield of refined products per barrel of crude petroleum. While the total recovery has changed but little, the amount of gasoline has more than doubled since 1914. This record is an indication of the improvement in technical processes.

Cement Manufacture.—The changes in the production factors of the cement manufacturing industry show the characteristics exhibited by the industries discussed above, but they are at a level lower than those that prevail for petroleum refining. The index numbers are given in Table 18. Production has consistently increased from 1919, accompanied by similar increases in productivity and primary power utilized. Their curves, as plotted in Chart 20, indicate no tendency to flatten. Unit prime cost began to drop in 1919 and by 1923 had reached a level which has since been substantially maintained.

CHART 20.—FLUCTUATIONS OF PRODUCTION FACTORS OF THE CEMENT MANUFACTURING INDUSTRY

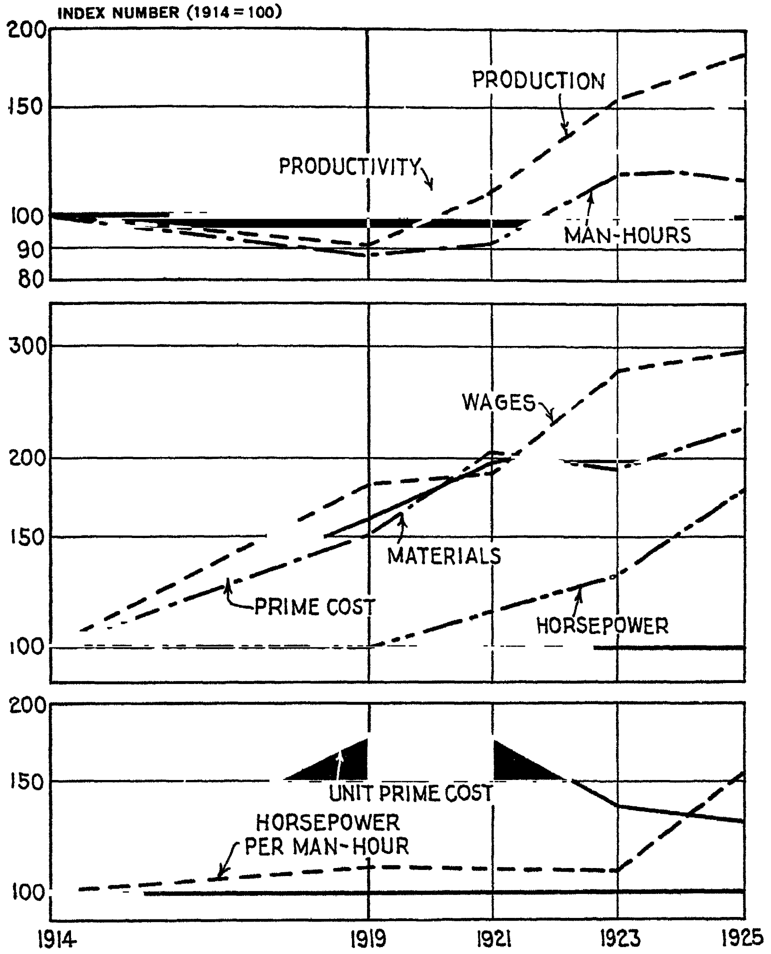
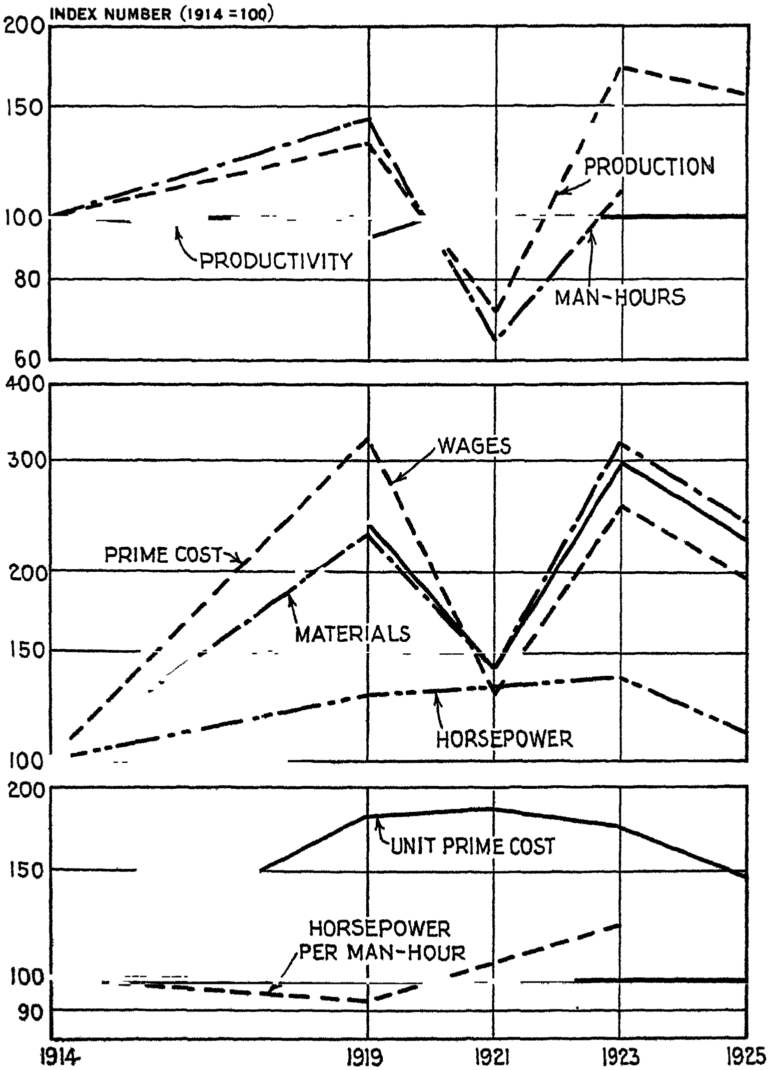


TABLE 18.—INDEX NUMBERS OF PRODUCTION FACTORS OF THE CEMENT MANUFACTURING INDUSTRY, 1914–1925

Year	Physical production	Man-hours	Productivity per man-hour	Wages paid	Cost of materials	Prime cost	Primary power	Primary power per man-hour	Unit prime cost
1914	100	100	100	100	100	100	100	100	100
1919	91	90	102	182	153	161	100	111	177
1921	111	92	121	190	198	195	.	. .	176
1923	156	120	130	274	193	215	131	109	138
1924	169	120	141	. . .	. .	. . .	. .	. .	. .
1925	183	116	158	296	220	240	178	154	131

CHART 21.—FLUCTUATIONS IN THE RECORD OF BLAST FURNACE OPERATIONS



Blast Furnaces.—The productivity increase of the pig iron industry, as shown by the record of blast furnace operations, is the lowest of the first class presented here. (See Table 19). The trends of production and primary power utilized are downward after 1923. The drop in unit prime cost, which began to show in 1921, does not become pronounced until after 1923. (See Chart 21).

TABLE 19.—INDEX NUMBERS OF PRODUCTION FACTORS OF THE BLAST FURNACE INDUSTRY, 1914–1925

Year	Physical production	Man-hours	Productivity per man-hour	Wages paid	Cost of materials	Prime cost	Primary power	Primary power per man-hour	Unit prime cost
1914	100	100	100	100	100	100	100	100	100
1919	133	139	95	324	234	242	129	93	182
1921	72	65	110	129	136	136	.	. .	189
1923	174	112	154	258	312	308	138	123	177
1925	157	[a]	[a]	199	233	230	113	...	147

[a] Figures included by Bureau of Labor Statistics in those for steel works and rolling mills.

Steel Works and Rolling Mills.—The characteristics of the principal production factors of steel works and rolling mills are similar to those presented for the pig iron industry. (See Table 20.) Productivity did not turn definitely upward until 1921. Primary power utilized has increased steadily since the base year 1914. Unit prime cost did not begin to drop until 1923. Production increased only slightly from 1923 to 1925. The factors are plotted in Chart 22.

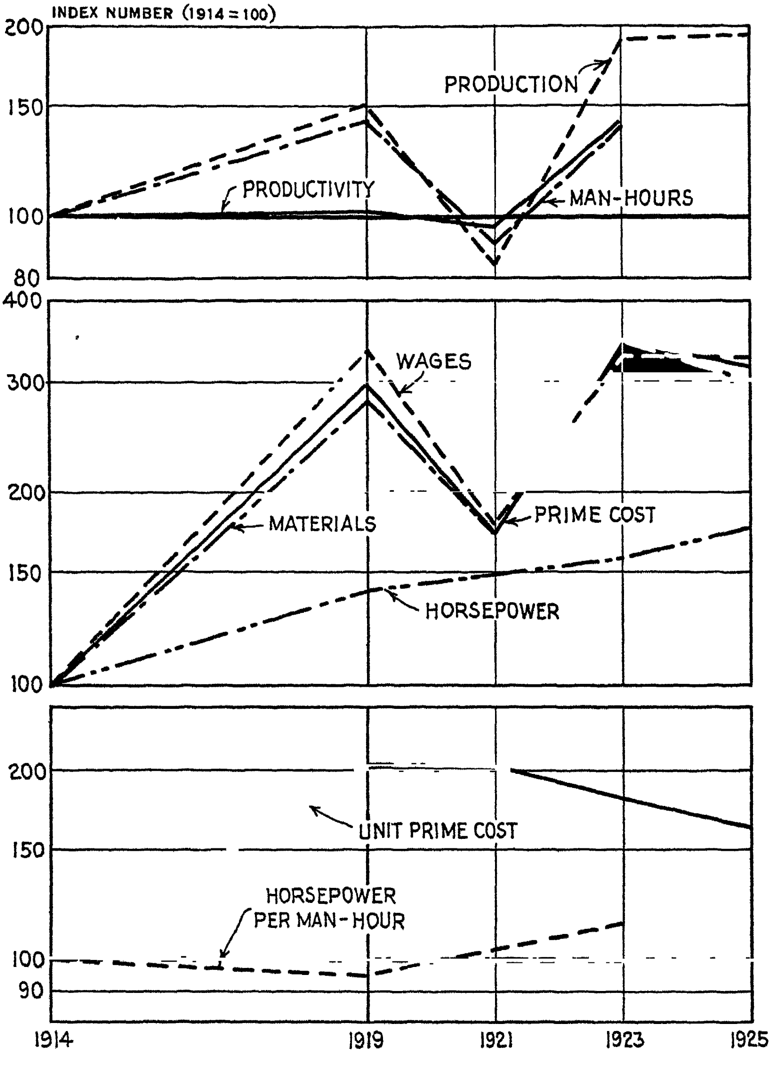
TABLE 20.—INDEX NUMBERS OF PRODUCTION FACTORS OF STEEL WORKS AND ROLLING MILLS, 1914–1925

Year	Physical production	Man-hours	Productivity per man-hour	Wages paid	Cost of materials	Prime power	Primary cost	Primary power per man-hour	Unit prime cost
1914	100	100	100	100	100	100	100	100	100
1919	148	147	101	339	284	298	141	96	201
1921	85	91	93	173	170	171	..	...	201
1923	192	139	138	340	346	346	160	115	180
1925	194	[a]121	[a]160	327	307	312	176	146	161

[a] Include figures for blast furnace industry.

Considering this group as a whole, these trends prevail: Production has increased from 1914 to 1925, but at a higher rate in the industries exhibiting the greatest increases in productivity. Productivity has consistently increased from 1919 through 1925. The utilization of primary power has increased at a nearly consistent rate in all cases and for only one industry has there been a drop from a high level previously attained. Unit prime cost has dropped consistently from 1919 on, except in two industries, namely, blast furnaces, and steel works and rolling mills, where the drop did not manifest itself until 1923.

CHART 22—FLUCTUATIONS OF PRODUCTION FACTORS IN STEEL WORKS AND ROLLING MILLS



Second Classification of Product Groups.—The six industries which fall into the second class of industrial product groups do not show equally consistent trends, nor the same characteristics for the various factors, as are exhibited by the first group. The basis of classification is productivity, and while those in the first class had an increase greater than 50 per cent, those in this class are in the range from 39 to 17 per cent. As before, each one of the product groups in this class will be discussed separately.

CHART 23.—FLUCTUATIONS OF PRODUCTION FACTORS OF THE FLOUR MILLING INDUSTRY

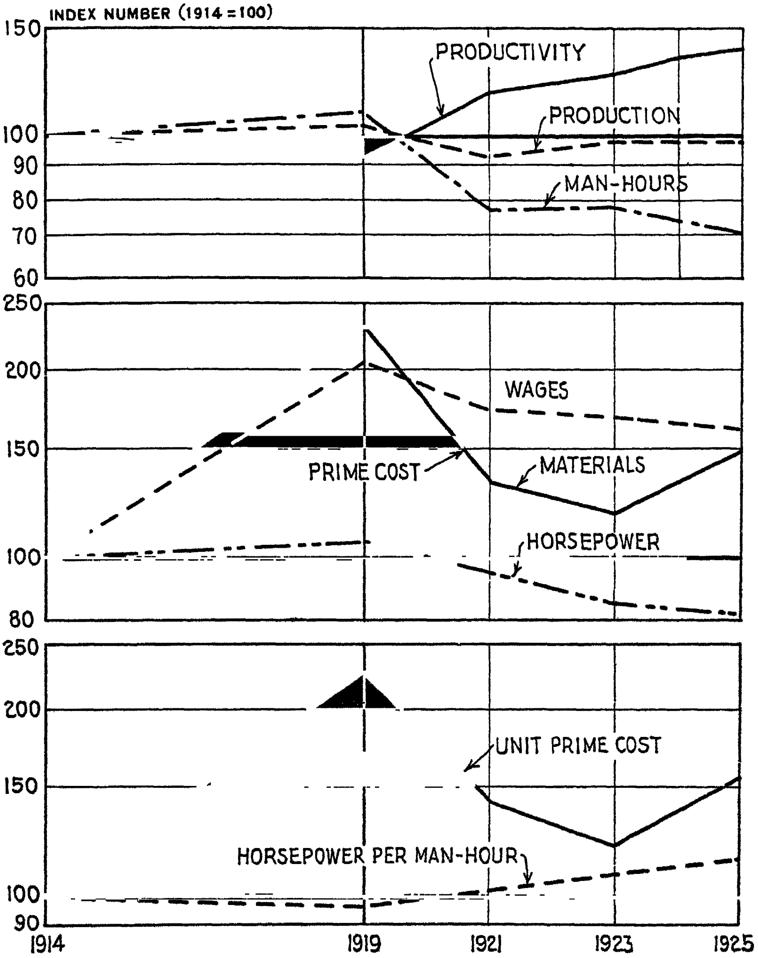


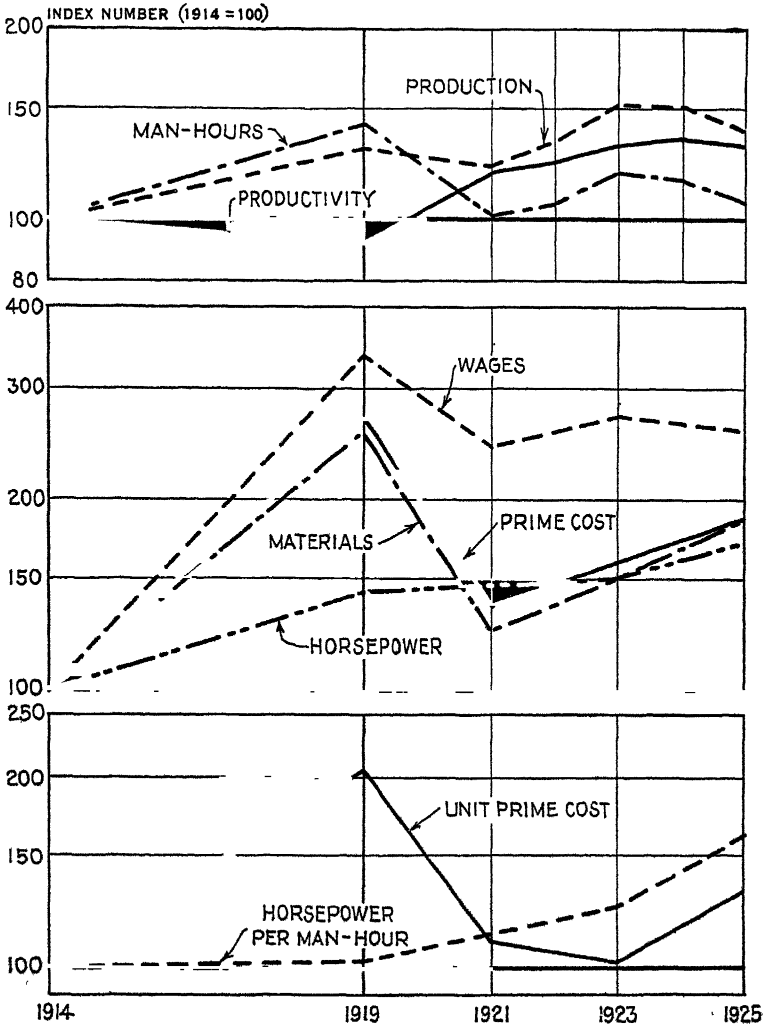
TABLE 21.—INDEX NUMBERS OF PRODUCTION FACTORS OF FLOUR MILLING INDUSTRY, 1914–1925

Year	Physical production	Man-hours	Productivity per man-hour	Wages paid	Cost of materials	Prime cost	Primary power	Primary power per man-hour	Unit prime cost
1914	100	100	100	100	100	100	100	100	100
1919 . . .	104	110	95	206	239	238	107	97	229
1921.	93	77	120	175	132	134	. .	. .	144
1923.	98	78	126	170	118	119	86	110	122
1924	98	74	133	. . .	. .	. . .	. . .	. .	. . .
1925 . . .	98	71	139	162	150	150	82	116	153

Flour Milling.—For the flour milling industry all of the factors show a decrease from 1919 to 1925 with the exception of productivity and primary power per man-hour, which have increased. (See Table 21 and Chart 23).

Slaughtering and Meat Packing.—For slaughtering and meat packing the factors lie at a higher level than the other industries in this class with the exception of productivity, which is exceeded by flour milling and leather tanning. (See Table 22). The curve, Chart 24, for production is irregular; that for primary power shows a continuous

CHART 24.—FLUCTUATIONS OF PRODUCTION FACTORS OF THE SLAUGHTERING AND MEAT PACKING INDUSTRY



and steady increase; the curve for man-hours is irregular, with a downward turn beginning in 1923; unit prime cost dropped sharply from 1919 to 1923 but turned upward again from 1923 to 1925.

TABLE 22.—INDEX NUMBERS OF PRODUCTION FACTORS OF SLAUGHTERING AND MEAT PACKING INDUSTRY, 1914–1925

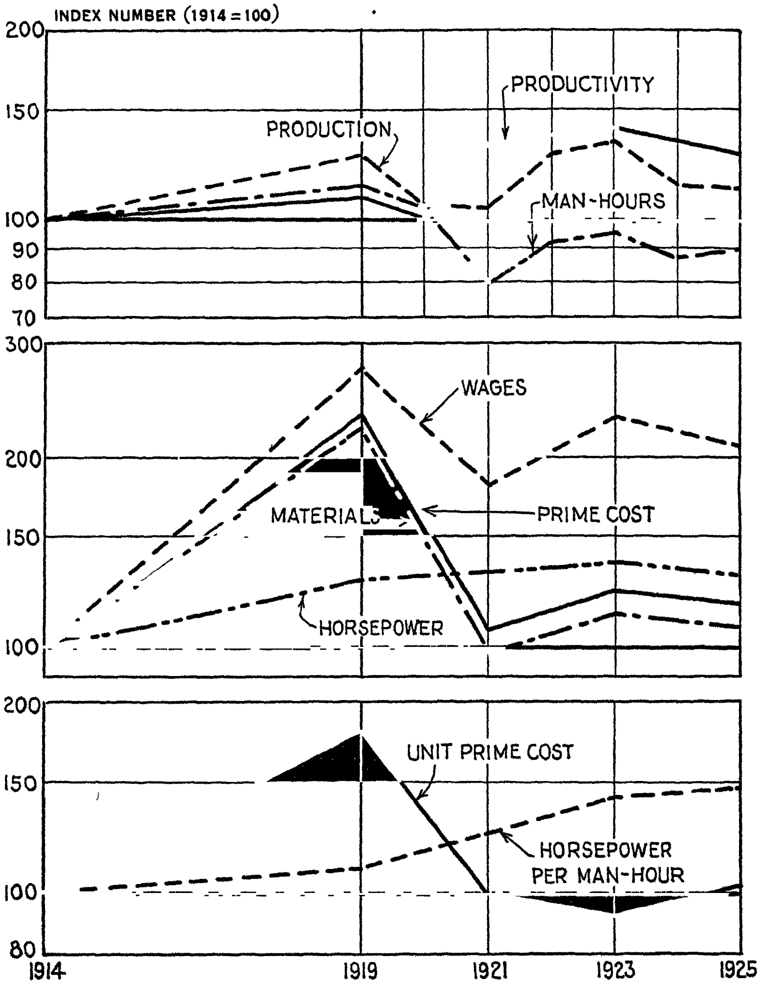
Year	Physical production	Man-hours	Productivity per man-hour	Wages paid	Cost of materials	Prime cost	Primary power	Primary power per man-hour	Unit prime cost
1914	100	100	100	100	100	100	100	100	100
1919	131	141	92	337	262	266	142	101	203
1921	122	102	119	246	129	135		.	111
1922	133	107	125		..	.			...
1923	153	120	128	270	151	157	151	126	103
1924	152	117	130	.	. .	..			...
1925	139	109	127	257	182	186	175	161	134

Leather Tanning.—The record of the leather tanning industry is quite similar to that for flour milling, as shown by the data of Table 23. Production which increased up to 1923 decreased from that date through 1925. (See Chart 25). Primary power which had increased continuously up to 1923 decreased through 1925. The change in the number of man-hours worked has been irregular, with the 1925 figure lower than in 1914. Productivity reached its highest level in 1923 and decreased slightly after that date. Unit prime cost began to decrease in 1919 with little change after 1921.

TABLE 23.—INDEX NUMBERS OF PRODUCTION FACTORS OF LEATHER TANNING INDUSTRY, 1914–1925

Year	Physical production	Man-hours	Productivity per man-hour	Wages paid	Cost of materials	Prime cost	Primary power	Primary power per man-hour	Unit prime cost
1914	100	100	100	100	100	100	100	100	100
1919	127	115	110	276	227	232	127	110	183
1920	106	104	101	...	...	...	..	...	.
1921	105	79	133	181	98	106	..	. .	101
1922	127	93	136	...	. .	..		.	...
1923	134	96	140	231	113	125	135	141	93
1924	115	86	134	.	.	.	..		
1925	114	89	128	209	108	118	130	146	104

CHART 25.—FLUCTUATIONS OF PRODUCTION FACTORS OF THE LEATHER TANNING INDUSTRY



Cane Sugar Refining.—Of the major factors, production, primary power utilized, and productivity, have increased. The number of man-hours worked has decreased steadily from 1919 on, and unit prime cost has also decreased, a decided drop occurring between 1919 and 1925. (See Table 24 and Chart 26).

CHART 26—FLUCTUATIONS OF PRODUCTION FACTORS OF THE CANE SUGAR REFINING INDUSTRY

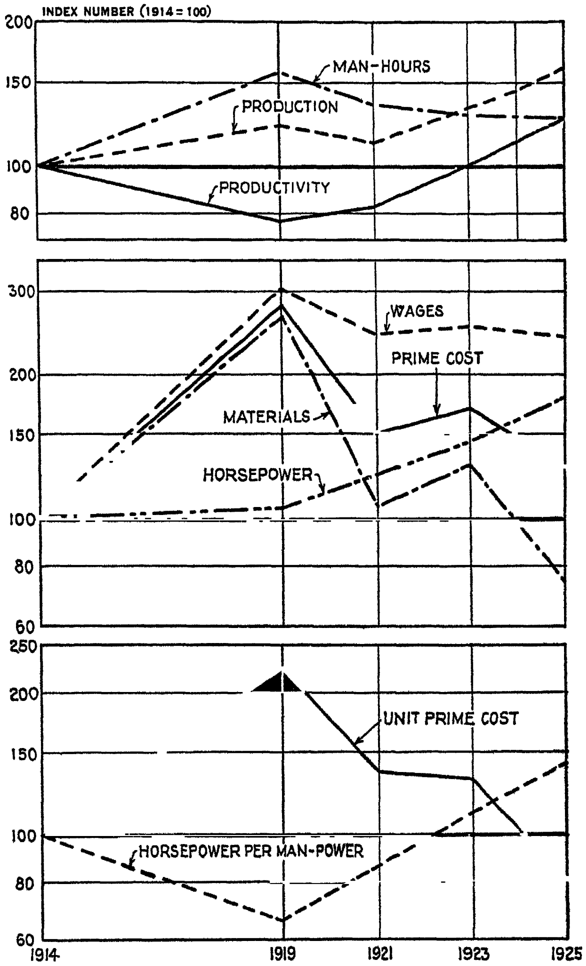


TABLE 24.—INDEX NUMBERS OF PRODUCTION FACTORS OF CANE SUGAR REFINING INDUSTRY, 1914–1925

Year	Physical production	Man-hours	Productivity per man-hour	Wages paid	Cost of materials	Prime cost	Primary power	Primary power per man-hour	Unit prime cost
1914	100	100	100	100	100	100	100	100	100
1919	123	158	78	290	277	281	106	67	228
1921	112	137	82	248	106	153	. .	. . .	137
1923	131	129	101	256	131	173	146	113	132
1924	143	127	113	. .	. .	. . .	. .	.	. . .
1925	161	126	127	242	73	128	179	142	79

Paper and Wood Pulp.—The data for production, man-hours, and productivity for this industry do not extend back beyond 1917, and are so shown in Table 25. Data for the other factors are given from 1914 to date. Production has had an irregular record since 1919, with 1921 as the low point, from which time there has been a steady increase. Man-hours have also been irregular, with a tendency to decrease since 1923. The resulting factor, productivity per man-hour, decreased from 1919 to 1921 and then has irregularly increased to 1925. Primary power has steadily increased in amount and utilization, the plotted curve in Chart 27 being nearly a straight line. Unit prime cost increased sharply from 1919 to 1921 and decreased thereafter, the 1925 point, however, being higher than the corresponding value for 1919.

CHART 27—FLUCTUATIONS OF PRODUCTION FACTORS OF THE PAPER AND WOOD PULP INDUSTRY

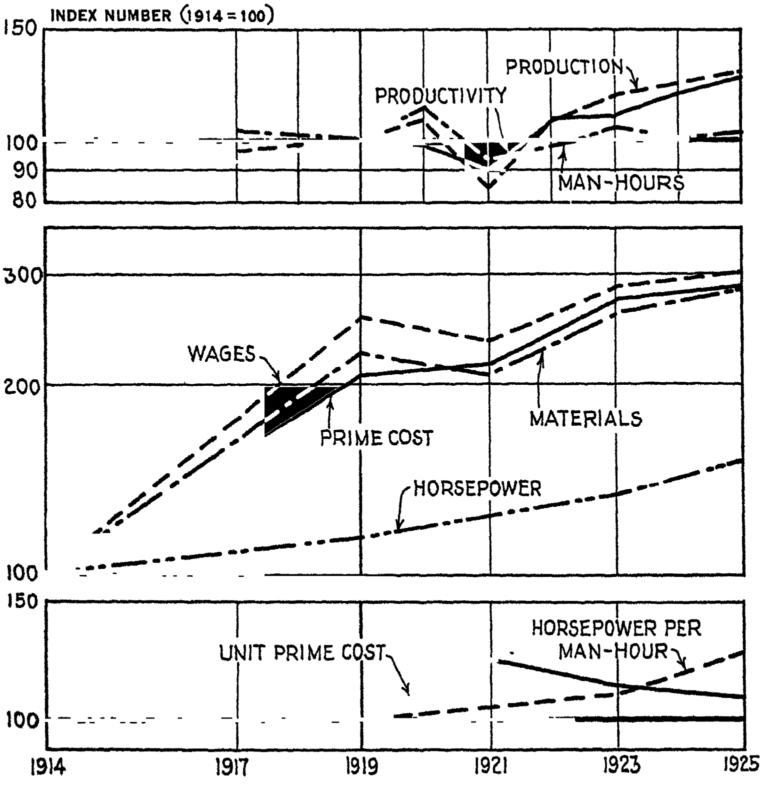


TABLE 25.—INDEX NUMBERS OF PRODUCTION FACTORS OF PAPER AND WOOD PULP INDUSTRY, 1914–1925

Year	Physical production	Man-hours	Productivity per man-hour	Wages paid	Cost of materials	Prime cost	Primary power	Primary power per man-hour	Unit prime cost
1914	. .		.	[a]100	[a]100	[a]100	87		
1917	96	103	94						
1918	98	101	98						
1919	[a]100	[a]100	[a]100	254	220	206	[a]100	[a]100	[a]100
1920	118	119	99						
1921	84	93	90	238	209	215			125
1922	106	97	109						
1923	117	106	110	284	259	272	117	110	114
1924	122	102	120						
1925	129	103	126	301	284	288	131	128	108

[a] Base year

Boots and Shoes.—The boot and shoe industry has the smallest increase in productivity of the product groups studied in this report. From 1914 to 1925 production has been irregular, with an over-all increase of only 10 per cent. (See Table 26). Primary power has increased at a

CHART 28.—FLUCTUATIONS OF PRODUCTION FACTORS OF THE BOOT AND SHOE INDUSTRY

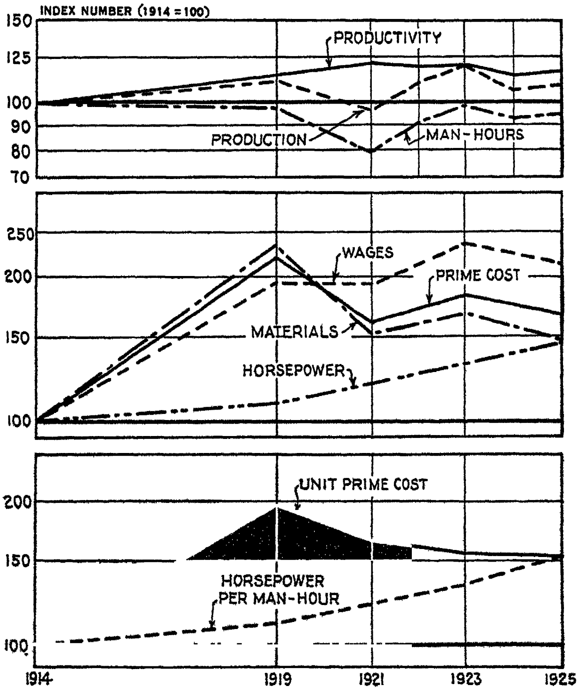


TABLE 26.—INDEX NUMBERS OF PRODUCTION FACTORS OF BOOT AND SHOE INDUSTRY, 1914–1925

Year	Physical production	Man-hours	Productivity per man-hour	Wages paid	Cost of materials	Primary cost	Prime power	Primary power per man-hour	Unit prime cost
1914	100	100	100	100	100	100	100	100	100
1919	113	99	115	198	230	222	110	112	196
1921	98	80	123	194	154	164		.	167
1922	111	91	121					.	
1923	120	99	121	237	173	187	134	135	156
1924	107	03	115	.				..	...
1925	110	95	117	213	150	170	146	154	154

TABLE 27.—INDEX NUMBERS OF PRODUCTIVITY PER MAN-HOUR FOR 12 PRODUCT GROUPS

(1914 = base year)

Year	Automobiles	Rubber tires	Petroleum refining	Cement manufacture	Blast furnaces	Steel works and rolling mills
1914	100	100	100	100	100	100
1917	...	...	..	. .	...	...
1918	...	..	.	. .	...	...
1919	141	130	92	102	95	101
1920	133	....	.	...	. .	...
1921	215	190	108	121	110	93
1922	264	.	122	.	.	..
1923	295	266	129	130	154	138
1924	289	301	158	141	..	..
1925	310	311	177	158	[a]	[b]160

Year	Flour milling	Slaughtering and meat packing	Leather tanning	Cane sugar refining	Paper and wood pulp	Boots and shoes
1914	100	100	100	100	...	100
1917	..	...	.	...	94	..
1918	.	.	.	. .	98	...
1919	95	92	110	78	[c]100	115
1920	...	...	101	. .	99	. .
1921	120	119	133	82	90	123
1922	...	125	136	..	109	121
1923	126	128	140	101	110	121
1924	133	130	134	113	120	115
1925	139	127	128	127	126	117

[a] Figure included in 1925 figure for steel works and rolling mills

[b] Includes figure for 1925 for blast furnaces.

[c] Base year for paper and wood pulp industries.

nearly uniform rate. The number of man-hours worked has been irregular with the largest number in recent years in 1923, and a decrease from that date to 1925. Productivity has been irregular, with the highest value in 1921, and has progressively decreased through 1924. The curve of unit prime cost in Chart 28, from 1919 on, has been irregular, with a tendency downward.

The industries in this second class show, in respect to the changes in major production factors, a record very different from those included in the first class. Not only are the levels of attainment lower but the changes are irregular and advantageous trends are not so pronounced.

In general, there has been some increase in production and each has shown a slight increase in productivity. Table 27 gives a comparison of productivity per man-hour for the 12 industries in the two classes discussed in the preceding pages. Not all have shown an increase in the utilization of primary power; in fact, several show actual decreases. There has been a decrease in the number of man-hours worked from 1919 on. As regards unit prime cost, all but one show a decrease from 1919, although few of the decreases are large in percentage, and several of them do not become evident until 1923.

To place the operating records of these product groups more sharply in comparison, Table 28 has been prepared. It gives the over-all percentage change, computed by the method of least squares, for the three unit factors—productivity per man-hour, primary power per man-hour, and unit prime cost—for each of the 12 product groups.

TABLE 28.—COMPARISONS OF OVER-ALL PERCENTAGE CHANGES IN THREE UNIT PRODUCTION FACTORS FOR 12 PRODUCT GROUPS

(Computed by method of least squares)

Industry	Over-all percentage changes, 1919–1925		
	Productivity per man-hour (per cent increase)	Primary power per man-hour[a] (per cent increase)	Unit prime cost (per cent decrease)
Automobiles	139	41	56.5
Rubber tires	142	...	...
Petroleum refining	[a]93	57	29
Cement manufacture	52	39	29
Blast furnaces	[b]66	[b]32	18
Steel works and rolling mills	[b]40	[b]20	20
Flour milling	42	20	38
Slaughtering and meat packing	34	59	38
Leather tanning	24	33	47
Cane sugar refining	69	112	64
Paper and wood pulp	32	28	[c]3.6
Boots and shoes	1	38	22

[a] Percentages calculated from terminal values.

[b] Percentage change from 1919 to 1923.

[c] Increase.

IV. SUMMARY

This report presents the results of a study into certain technical changes that have occurred in the operation of manufacturing industries during the past decade.

The recent turning point in the more economical utilization of production factors seems to have taken place about 1919–20. For many of them, and for a number of product groups, this favorable change has continued through the year 1925, the last for which national statistics are available. Among these trends are:

An increase in physical volume of product.

An increase in productivity of the individual worker or of the man-hour worked.

An increase in primary power utilized both in total volume and in amount per employee.

An increase in the total amount, and also in the proportion, of horse power for industrial purposes which is purchased instead of being self-produced.

A decrease in the number of workers employed.

An increase in fixed capital assets, that is, in manufacturing buildings, equipment, and machinery.

A decrease in unit prime cost.

An increase in the attention given, resources available, and funds spent for industrial research.

Increase in the development of new manufacturing materials.

Increase in the development of new manufacturing processes.

Increase in the efficiency of power-generating machinery.

Increase in material-handling machinery utilized, both to reduce the cost of transporting materials and product and to act as a pace-maker for the speed of production.

Reduction in wastage of manufacturing materials and the reclaiming of former waste products through the development of by-products.

Increase in safety of industrial establishments, with safeguarding carried to such a degree that the greater number of industrial accidents are now attributable to supervisory failure, not to a physical cause.

Increase in the extent, degree, and quality of artificial illumination.

Improvement in working surroundings and in those physical conditions that can be modified by technological means.

However, the degree of improvement in the utilization of production factors differs in various industries. Only a limited number of product groups have been studied but these fall into two classes—the first commonly looked upon as prosperous, and many of the second as notoriously in trouble and beset with economic and business difficulties.

A comparison of the records of these two groups shows that the second has not made the same increases in the utilization of production factors as the first. This fact seems to point to the place where improvement may be initiated.

PART 3.—THE CHANGING STRUCTURE OF INDUSTRY

BY WILLARD L. THORP

I. RECENT TRENDS IN THE SCALE OF PRODUCTION

Scale of Production in Terms of Wage Earners.—The reduction from ten years to five, and then from five to two, in the interval between the taking of succeeding censuses of manufactures has given us excellent material concerning the scale of production. All census data are given in terms of establishments.[1] From these records, it is possible to measure the trends in size of establishments in three ways: by wage earners, by horse power, and by value of products. Taking the simplest measure of all, the arithmetic average of all establishments reporting, these criteria are recorded by the Bureau of the Census as shown in Table 1.

TABLE 1.—AVERAGE SIZE OF ALL ESTABLISHMENTS REPORTED IN THE CENSUS OF MANUFACTURES, 1914–1927[a]

Census year	Wage earners per establishment		Horse power per establishment		Value of products per establishment	
	Actual	Relative	Actual	Relative	Actual	Relative
1914	39.0	100	126.2	100	$135,080	100
1919	42.1	108	137.1	109	288,990	214
1921	35.5	91	[b]	[b]	222,072	164
1923	44.8	115	169.0	134	308,101	228
1925	44.7	115	191.0	151	334,669	248
1927	43.5	112	203.4	163	[c]325,990	241

[a] In order to make the figures comparable, data for establishments producing products under $5,000 have been eliminated for the years 1914 and 1919, with the exception of horse power, for which data are not available to make the correction. The data for establishments engaged in automobile repairing and those for purchased power other than electric have been omitted from the figures for 1919 and 1914, no such data having been tabulated at censuses subsequent to 1919, and the data for coffee roasting and spice grinding have been omitted from the figures for 1923 and prior years, no such data having been tabulated in 1925.

[b] Not collected by the Bureau of the Census.

[c] The value of products is made comparable with that for earlier years by combining paper and wood pulp into a single industry.

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[1] In definition, the Bureau of the Census states: "As a rule the term 'establishment' signifies a single plant or factory. In some cases, however, it refers to two or more plants operated under a common ownership and located in the same city, or in the same State but in different municipalities or unincorporated places having fewer than 10,000 inhabitants. On the other hand, separate reports are occasionally obtained for different industries carried on in the same plant, in which event a single plant is counted as two or more establishments."

These figures indicate a slight advance in the number of wage earners per establishment, a considerable advance in horse power, and a more than doubling in the value of products per establishment.

The record for value of products per establishment is a somewhat misleading criterion of size. It reflects not only the increase in the quantity of output, but also the changes in the prices of commodities. If prices doubled, one would expect the value of products per establishment to double, but this could not be taken as a significant change in the scale of production. The figure for value of products may be taken as an indirect indication that the physical output per establishment has increased, because the value of products has increased much more than any of the indexes of prices from 1914 to 1925.[2]

But averages, while helpful, are not always dependable. The Census Bureau subdivides manufacturing establishments into groups according to the average number of wage earners employed. This tabulation was omitted from the Census of 1925, but the record for earlier years is shown in Table 2. To one not familiar with these figures, perhaps the most amazing fact is the number of small establishments in modern industry. To this array, one interested in small establishments should add those which employed less than six wage earners and were excluded from the tabulation above, amounting in 1923 to nearly 90,000 establishments. That the number of establishments in the United States averaging 1,000 wage earners is less than 1,000, is contrary to the usual impression of the United States as a country of enormous factories and mass production. The small establishment shows no

TABLE 2.—DISTRIBUTION OF ESTABLISHMENTS EMPLOYING SIX OR MORE WAGE EARNERS, BY NUMBER OF WAGE EARNERS PER ESTABLISHMENT, 1914-1923[a]

Wage earners	Number of establishments			
	1914	1919	1921	1923
6 to 20	53,954	54,317	53,771	54,609
21 to 50	22,879	25,176	23,898	25,212
51 to 100	11,070	12,370	11,047	12,346
101 to 250	8,465	10,054	8,532	10,023
251 to 500	3,108	3,596	2,916	3,835
501 to 1,000	1,348	1,749	1,241	1,784
Over 1,000	648	1,021	645	963

[a] It is assumed that, by omitting all establishments with less than six wage earners, the fact that the censuses of 1914 and 1919 included establishments whose products were valued at less than $5,000, whereas the later censuses did not, may be disregarded

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[2] The index of wholesale prices published by the United States Bureau of Labor Statistics, recomputed to a 1914 base, is: 1914, 100; 1919, 210; 1921, 150; 1923, 157; 1925, 162.

tendency to disappear, despite the large concerns. But the data giving merely the number of establishments do not fairly indicate the importance of the larger plants. The 6,582 establishments employing more than 250 wage earners in 1923 represented less than 4 per cent of all establishments, yet they employed four and a half million wage earners, or slightly more than one-half.

A careful scrutiny of the distributions, group by group, indicates that there is some increase in the numbers in the larger-size groups when compared with the prewar distribution. To be sure, 1914 was not a good business year, but 1921 was much worse, and its distribution is almost identical with that of seven years before.

The trend since 1923 can be determined from Table 3, which shows the distribution of establishments grouped according to the value of products for 1923 and 1925. The trend of prices has been sufficiently stable during the period so that it can be disregarded, with reservations. The figures for earlier years are not given because the violence of the price changes makes them misleading.

TABLE 3.—DISTRIBUTION OF ESTABLISHMENTS, BY VALUE OF PRODUCTS PER ESTABLISHMENT, 1923 AND 1925

Value of products	Number of establishments	
	1923	1925
$5,000 to $20,000	61,881	55,876
20,000 to 100,000	72,139	68,951
100,000 to 500,000	41,818	42,209
500,000 to 1,000,000	9,494	9,771
Over $1,000,000	10,248	10,583

The decline in number of establishments whose value of products is less than $100,000, and the increase in the larger establishments, is apparent. It is evident that the number of large establishments, using the volume of business as an indicator, is slowly increasing.

While the above facts show that industrial establishments are operating on a somewhat larger scale, they do not show whether industries are so doing. It is conceivable that every plant in the country might be decreasing its scale of production yet industry as a whole be advancing. For example, although the average size of establishments engaged in automobile manufacture has decreased since 1919, the increasing importance of the industry, coupled with the fact that in size it is still far above the average for all industry, tends to raise the average for industry in general during the period.

For the purpose of examining the behavior of the various separate industries, the data for the censuses of 1914, 1919, 1921, 1923, and 1925 were regrouped so that 321 consistent industrial groups were created. A small number of establishments were omitted where entirely new classifications had been made in such a way that no combinations could include them in a consistent industry group. The records for establishments producing under $5,000 of product were eliminated from the 1914 and 1919 figures, except in the case of horse power. However, the amount of horse power in these small establishments is estimated to be so small as to be negligible.

Among these 321 industries, the average number of wage earners per establishment in 1925 ranged from 1.2 in the cheese industry, to 1,086.9 in the rubber boot and shoe industry. Seven industries averaged over 500 workers per establishment, and 70 over 100. The average of the various industries, in which each industry is regarded as of equal significance, was 86.2 wage earners. The median industry employed but 39.8 workers.

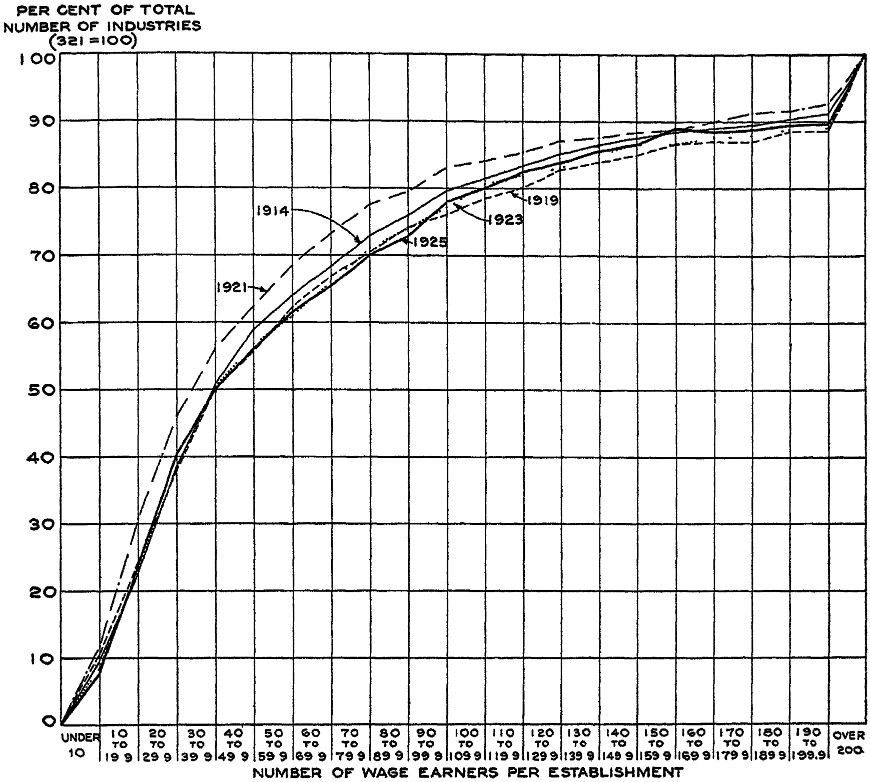
The above figures for 1925 do not vary greatly from those for the other years studied. In each instance, the bulk of the industries are in the small-size groups, but a sufficient number operated on a large scale to make the arithmetic average at least twice the median. The concentration in the smaller groups is depicted by the following charts of frequency distributions. A few industries with more than 200 wage earners per establishment are not included.

The industries are so concentrated in the smaller-size groups that it is impossible to determine what the tendencies actually are.[3] The same data as given in Chart 1, but grouped according to a logarithmic scale, appear in Chart 2.

It is evident that there has been a marked reduction in the number of industries included in the smallest groups, and a tendency to concentrate about the group centering at 20 workers per establishment. The mode, which was clearly in the 25–40 group in 1919, has moved back to the 16–25 group. While there is a slight tendency to form a secondary peak centering about 100 workers per establishment, the surprising thing about the distributions is the actual decrease in the number of industries in the larger groups. There has been a decline in those industries averaging more than 100 wage earners per establishment from 77 in 1919, to 73 in 1923, and 70 in 1925. The trend depicted, therefore, is not one of general advance or general decline, but of the extremes moving in toward the middle, tending to center about 20 and about 100 workers per establishment.

[3] A clearer picture of the trend is obtained when the distributions are made on a logarithmic basis. Furthermore, it is probably true that these data, like so much other economic material, tend to vary in terms of equal percentage changes rather than in absolute terms. Certainly, an increase in the scale of production from 5 to 10 wage earners is much more significant and extraordinary than an increase from 250 to 255.

CHART 1.—DISTRIBUTION OF 321 INDUSTRIES ACCORDING TO AVERAGE NUMBER OF WAGE EARNERS

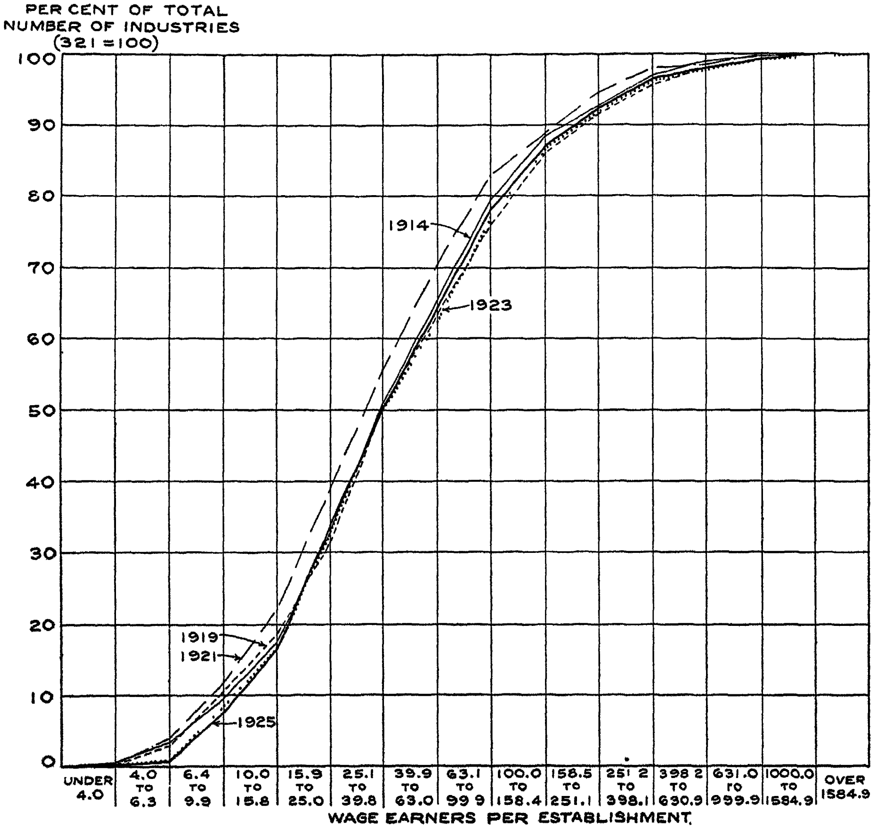


Not only do the frequency distributions fail to show any marked trend toward the increasing adoption by old industries of large-scale production, but the simpler averages indicate much the same thing. These are given in Table 4.

TABLE 4.—AVERAGE SIZE OF 321 INDUSTRIES, BY NUMBER OF WAGE EARNERS EMPLOYED, VARIOUS AVERAGES, 1914–1925

	1914	1919	1921	1923	1925
Actual numbers for each industry:					
Arithmetic mean	81.7	94.4	71.0	91.1	86.2
Median	38.3	38.8	34.0	38.7	39.8
Geometric mean	42.1	44.4	36.1	44.5	43.1
Fixed base relatives for each industry (1914 = 100):					
Arithmetic mean	100	115	93	113	112
Median	100	104	86	105	100
Geometric mean	100	107	87	106	105

CHART 2.—DISTRIBUTION OF 321 INDUSTRIES ACCORDING TO NUMBER OF WAGE EARNERS



The variations from year to year are explained by the fact that 1914 and 1921 were dull years, and that 1919, 1923, and 1925 were active years. It is interesting to note that 1925 represents a definite decline from 1923 by every measure but one. The geometric means, which are unquestionably the most reliable in this instance, depict 1919 and 1923 as the peak years. Certainly, there is no general trend upward. In fact, comparing 1925 with 1914, there were 155 industries which recorded an increase in the average number of wage earners employed per establishment, 157 which recorded a decrease in the average number of wage earners, and 9 which reported no change in the scale of production.

Not only has the central measure of the frequency distribution shown little change during the period, but also the industries within the distribution have tended to keep much the same general position. There are, of course, certain industries which have increased their scale of production tremendously. The eighteen industries which have at least doubled their average number of wage earners per establishment between 1914 and 1925 are shown in Table 5.

TABLE 5.—EIGHTEEN INDUSTRIES REPORTING THE LARGEST INCREASE IN THE NUMBER OF WAGE EARNERS PER ESTABLISHMENT, 1914–1925

Industry	Number of wage earners per establishment	
	1914	1925
Aircraft and parts	14.0	61.4
Corn syrup, corn oil, and starch	53.6	216.4
Asbestos products	41.2	125.1
Engines and waterwheels	78.8	232.3
Gold, silver, and platinum, reducing	6.9	19.4
Motor-vehicle bodies and parts	62.2	168.2
Pens, fountain and stylographic	25.5	58.1
Washing machines, etc.	33.2	86.3
Motor vehicles	274.3	665.8
Optical goods	30.4	73.9
Carbon black	9.5	21.8
Musical instruments	20.3	45.6
Roofing materials	28.6	59.4
Printing materials	6.1	12.5
Carriages and wagons	15.6	31.8
Babbitt metal, white metal, etc	10.8	21.9
Baking powder, yeast, etc	29.4	59.8
Fire extinguishers, chemical	16.1	32.4

The list in Table 5 includes but few industries which one ordinarily regards as having undergone marked transformation in recent years. In some cases, as in aircraft, the industry has recorded expansion in all respects, with the number of establishments nearly trebling, and the number of wage earners multiplying 16 times. On the other hand, the corn syrup industry, second on the list, gained its position by a reduction in the number of establishments by approximately one-third, coincident with a slight increase in the total number of wage earners.

The tendency toward concentration about the average is evident in this material, also. If all the industries examined were arranged according to the scale of production in 1914, those listed in Table 5 as recording the greatest gains would appear in the array as follows: Lowest quarter, 8; second quarter, 5; third quarter, 4; highest quarter, 2. In other words, the advances are being made in those industries which are at the lower end of the scale rather than those which are already operating under conditions of large-scale production.

On the other hand, there are other industries which have reported a marked decline in their scale of production during this same period. Table 6 presents the 15 industries whose scale of production was reduced by 40 per cent or more between 1914 and 1925.

TABLE 6.—FIFTEEN INDUSTRIES REPORTING THE GREATEST DECLINE IN NUMBER OF WAGE EARNERS PER ESTABLISHMENT, 1914–1925

Industry	Number of wage earners per establishment	
	1914	1925
Grindstones, pulpstones, etc	68.2	21.6
Phonographs	521.2	165.7
Whips	34.8	11.4
Galvanizing and other coating	37.4	14.0
Engraving, wood	12.2	5.3
Nets and seines	95.5	42.2
Watch materials	42.4	20.0
Corsets	162.1	78.5
Carriage materials	33.0	17.2
Feathers, plumes, etc	23.0	12.7
Watch cases .	140.3	77.3
Lapidary work	13.0	7.1
Condensed milk	31.7	17.7
Wooden goods	41.0	22.9
Silk manufactures, finished	134.3	76.8

Most of these 15 industries have suffered from a loss of market. The tendency has been for the establishments to persist, operating on a greatly reduced basis, with the result that they report a decrease in the number of wage earners. It is interesting to note that the declines are more prevalent among the larger-scale industries than were the advances. But in general, the internal changes have not been marked. Of the 321 industries studied, the change in size of establishment between 1914 and 1925 was less than 20 per cent in 159 cases, and less than 40 per cent in 251 industries.[4] There are few instances of industrial collapse, such as steel shipbuilding after the war, but even there, the scale of production remained large in the few establishments which survived.

It is interesting to observe how little the industries leading in scale of production have changed. The same five industries are found at the top in 1925 which were there in 1914. The changes among the leading ten industries during the period are presented on page 175.

Most of the industries are on the list for obvious reasons—because of the size of the product, as the locomotive industry; the complexity of the product, as watches and motor vehicles; or the complexity of the process, as steel rolling mills, rubber products, and copper smelting. Perhaps most interesting are two new entrants to the list in recent years, wool carpets and floor oilcloth. Both are industries in which the products have been greatly developed within the last few years, and which are now made on a large scale.

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[4] The coefficients of rank correlation are: 1914–1919, +.946; 1919–1921, +.975; 1921–1923, +.980; and 1923–1925, +.986. If the industries were in identical rank, the coefficient would be +1.0; if completely reversed, −1.0.

1914	1919	1921	1923	1925
Watches	Locomotives	Boots and shoes, rubber	Locomotives	Boots and shoes, rubber
Locomotives	Boots and shoes, rubber	Sugar refining, cane	Boots and shoes, rubber	Watches
Boots and shoes, rubber	Sugar refining, cane	Locomotives	Steel rolling mills	Steel rolling mills
Sugar refining, cane	Watches	Watches	Sugar refining, cane	Locomotives
Steel rolling mills	Steel rolling mills	Steel rolling mills	Smelting, copper.	Sugar refining, cane
Phonographs	Motor vehicles	Cars, electric and steam	Motor vehicles	Motor vehicles
Cars, electric and steam	Ammunition	Screws, wood	Watches	Smelting, copper
Smelting, copper	Cars, electric and steam	Motor vehicles	Cars, electric and steam	Carpets, wool
Sewing machines	Sewing machines	Pencils	Oilcloth, floor.	Oilcloth, floor
Ammunition	Firearms.	Sewing machines	Carpets, wool	Screws, wood

A similar list of industries producing on a smaller scale would note certain industries regularly in that position—cheese, artificial limbs, butter, beverages, and flour milling, while wood engraving and mucilage have recently joined them. Although it appears on the list of smallest-scale operations, the flour milling industry in 1923 had one establishment employing over 1,000 wage earners.

Scale of Production in Terms of Horse Power.—The record for horse power per establishment offers a much clearer picture of growth. The census figures refer to the total rated horse-power capacity of engines, motors, and other prime movers. Motors run by power generated within the establishment are excluded as involving duplication, since the power producer which runs the generator is already included. Because the figures refer to total rated capacity, they are considerably larger than if they were the amount of power in actual daily use.[5]

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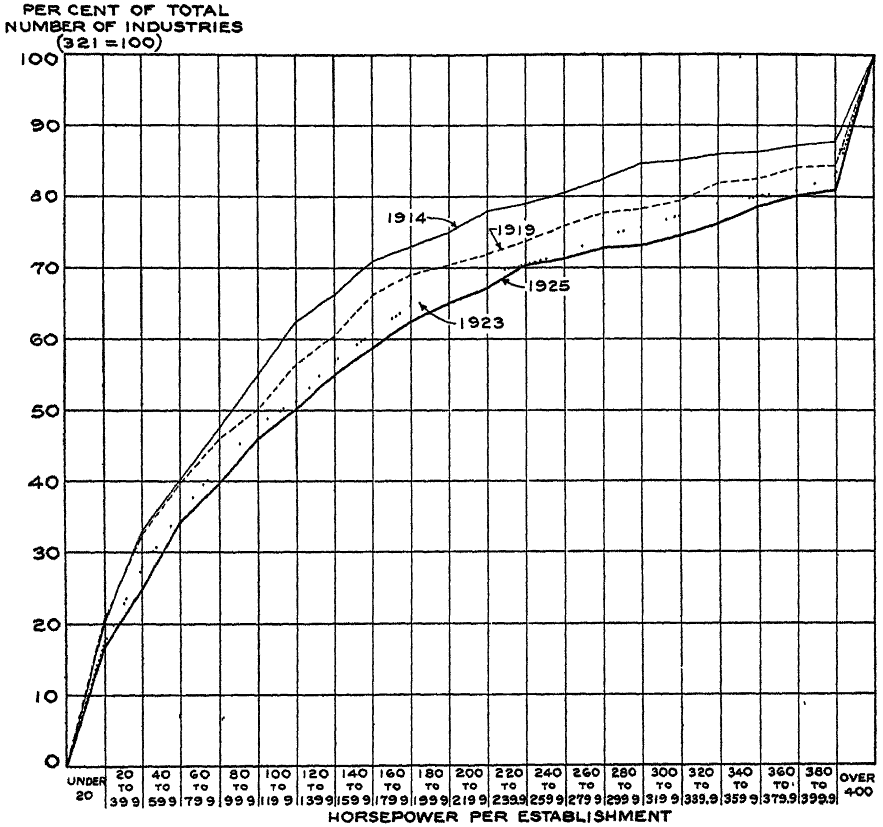
[5] Further qualifications in the use of the horse-power figures have been suggested by LeVerne Beales, chief statistician for manufactures in the Census Bureau. The marked reduction in steam engines and increase in steam turbines during the period 1919 to 1925, results in an apparent reduction in horse power. The lower efficiency of the steam engine, and the belt system which usually accompanies it, when compared with the steam turbine used to drive an electric generator, is so considerable that the rated horse power necessary to do the same work is greater in the first than in the second case. As a second consideration, there is the fact that the greatest gain in prime movers during the period was made by electric motors driven by purchased current. When driven by current produced within the plant, the horse power of the engine driving the generator is of course the prime mover. But it often happens that a generating power of 500 horse power is found in a concern having electric motors rated at perhaps 1,000 horse power. The difference is due to the fact that many motors are idle or not run at capacity continually. The prime mover is recorded as 500 horse power. If this company changes to rented power, the prime mover record will be 1,000 horse power, or the rated capacity of the electric motors.

As one might expect, the range of power capacity among the industries is tremendous. The hairwork industry, with 87 establishments, reports but 13 horse power in total, or less than 0.15 per establishment. At the other extreme is the copper smelting industry with 26 establishments and a total of 326,509 horse power, or 12,558 horse power per establishment.

CHART 3.—DISTRIBUTION OF 321 INDUSTRIES ACCORDING TO AVERAGE HORSE POWER PER ESTABLISHMENT



The distribution of the 321 industries, according to horse power per establishment, is depicted in Chart 3. The industries reporting over 400 horse power per establishment are excluded from the chart. The concentration at the left of each distribution is similar to that observed in the distributions based on the average number of wage earners per establishment. The distribution on a logarithmic basis, Chart 4, very clearly depicts the trend. The smaller groups are all decreasing in the number of industries which they include, while the larger groups are gaining.

The average values for the industries emphasize the steadiness and degree of the advance. That this tendency is general, is indicated by the fact that in 1925 five-sixths of the industries showed increased horse power over 1914.

CHART 4.—DISTRIBUTION OF INDUSTRIES ACCORDING TO AVERAGE HORSE POWER PER ESTABLISHMENT

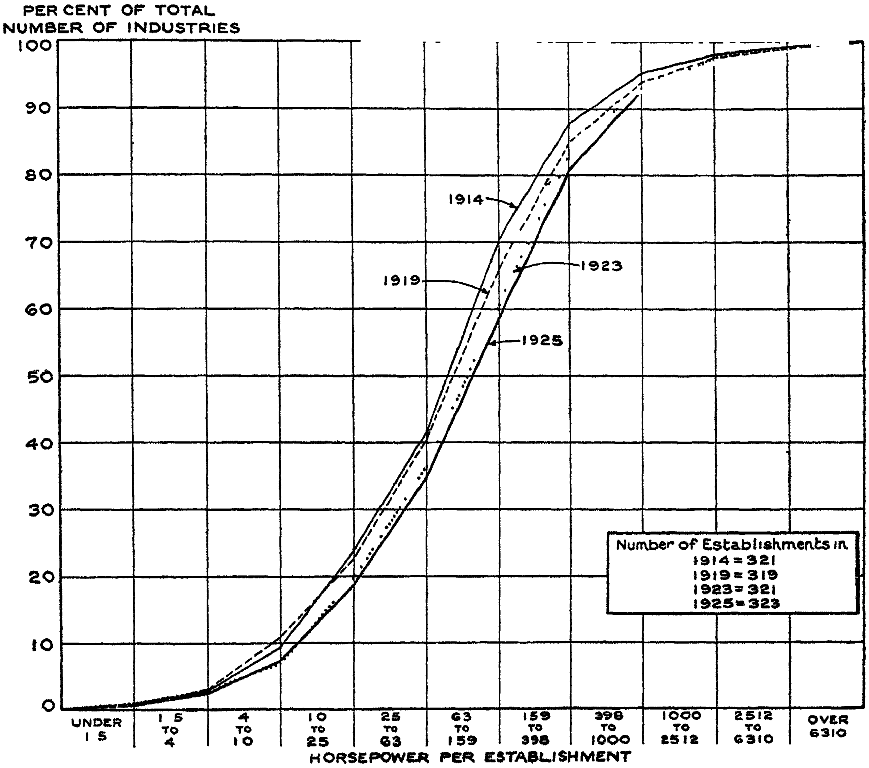


TABLE 7.—AVERAGE SIZE OF 321 INDUSTRIES IN TERMS OF HORSE-POWER CAPACITY PER ESTABLISHMENT, 1914–1925

	1914	1919	1923	1925
Arithmetic mean	254.3	325.3	385.0	429.6
Median	87.5	97.6	113.4	118.7
Geometric mean	74.0	79.8	98.8	107.7

There is much more stability in the list of industries ranked by horse power than by wage earners. Whereas workers can be easily added or subtracted, and the employer is not committing himself to any long-time arrangement in employing them, machinery can be much less easily adjusted. Once purchased, it remains and must be used. As a result, the addition of machinery is a step to be taken with great deliberation, and, once taken, must be followed through. It is interesting to note how little the ranking of the leading ten industries is subject to variation. The following presentation shows the leading ten industries ranked according to horse power per establishment:

1914	1919	1923	1925
Iron and steel, blast furnaces	Smelting, copper.	Smelting, copper	Smelting, copper
Iron and steel, rolling mills	Iron and steel, blast furnaces	Iron and steel, blast furnaces.	Iron and steel, blast furnaces
Smelting, copper	Iron and steel, rolling mills	Iron and steel, rolling mills.	Iron and steel, rolling mills
Cement	Locomotives	Cement.	Locomotives
Locomotives.	Cement	Locomotives	Cement.
Sugar refining, cane	Sugar refining, cane	Sugar refining, cane.	Sugar refining, cane
Paper and wood pulp	Paper and wood pulp.	Paper and wood pulp.	Paper and wood pulp
Wire.	Smelting, lead.	Boots and shoes, rubber.	Smelting, zinc.
Smelting, lead.	Boots and shoes, rubber.	Corn syrup	Smelting, lead.
Cotton goods	Smelting, zinc.	Smelting, lead.	Boots and shoes, rubber

Every instance is an industry of elaborate technical process and vast machinery. The lists in 1919 and 1925 are identical, except for a change in the order in the last three places.

Certain industries which appear on this list were included in the list for largest size in terms of wage earners. Five were included among the 10 largest in terms of wage earners, two were in the second 10, two were in the third 10, and paper and wood pulp, farthest down the list, ranked forty-third with over 160 wage earners per establishment. A further examination of other industries indicates that there is a close relationship between the number of wage earners and the amount of horse power in the various industries.[6]

Not only does a relationship exist, but the two tend to change together. And this change is not, as is often stated, an advance in horse power and a resulting decline in workers. The facts show that increases in horse power and increases in wage earners usually go together. While individual plants and individual industries may run counter to

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[6] The rectilinear coefficient of correlation, based on the logarithms of the data, gave the following results.

Year	Coefficient	Regression line
1914	+ 72	Log WE = 526 Log HP + .635
1919	+.78	Log WE = 543 Log HP + .554
1925.	+ 74	Log WE = 501 Log HP + .643

The coefficient is sufficiently high, especially since it is based on 321 items, to be accepted as demonstrating an existing relationship between these two items.

this tendency, the record, as presented by the selected 321 industries, is clear. It is summarized in Table 8.[7]

TABLE 8.—DISTRIBUTION OF 302 MANUFACTURING INDUSTRIES ACCORDING TO CHANGES IN WAGE EARNERS AND HORSE POWER PER ESTABLISHMENT, 1923–1925

Per cent change in wage earners per establishment	Per cent change in horse power per establishment					
	Decrease		Increase			
	20 to 40 per cent	0 to 20 per cent	0 to 20 per cent	20 to 40 per cent	40 to 60 per cent	60 to 80 per cent
Decrease:						
20 to 40 per cent	4	12	8	1	.	.
0 to 20 per cent	8	49	66	15	7	.
Increase.						
0 to 20 per cent	5	12	54	25	5	7
20 to 40 per cent		2	5	10	1	1
40 to 60 per cent		1	2	1	..	1

If one keeps in mind the fact that horse power is gaining on the average much more than wage earners, Table 8 can be accepted as a clear demonstration of the interrelation between the two devices which have been used to measure size. There are cases where horse power is gaining and wage earners are declining, and there are cases where the number of wage earners is increasing and horse power is declining. But the central tendency is for a parallel development.

II. RECENT TRENDS IN THE SCALE OF OPERATION

The story of the structure of modern industry is not completed by discussing the scale of production. In 1919, the records of the Census Bureau indicated that more than 20,000 establishments, at the very least, were not independent enterprises, but were parts of larger organizations which included other manufacturing establishments. It was estimated that these establishments employed at least one-third of the wage earners engaged in manufacturing and produced an even greater percentage of the total product.[8]

There are no official data that describe adequately these combinations among the producing units. The methods by which several concerns may be brought under a single centralized control may be so hidden that no amount of investigation among current sources will disclose the actual situation. The Federal Trade Commission has struggled to unravel the complexities in some few isolated cases—the meat packers, the bakers, and the public utilities in particular. But we cannot generalize for industry as a whole from these few samples. Studies have been made of capitalization, but the difference between the total capitalization, as stated on the balance sheet, and the actual size of the enterprise may be so great as to render this material meaningless for our purpose.

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[7] Nineteen industries, with variations exceeding the limits stated, are not included.

[8] Willard L. Thorp, *The Integration of Industrial Operation.* Census Monograph No. 3. Washington, 1924, p. 104.

The Size of Corporations.—The records of the Bureau of Internal Revenue, collected in connection with the income tax, have some bearing on this point. If industry were becoming more concentrated, one might expect an increasing number of concerns falling in the larger income groups. On the other hand, income-tax returns are notoriously subject to manipulation. The changes in rates from time to time have tended to increase or decrease the incentive toward evasion.[9] Finally, reports may be rendered by subsidiary corporations as though they were independent. Despite these hazards, it seems desirable to present the following table, giving the number of corporations reporting a net income of $100,000 or more for the years 1918 and 1920 to 1926 by eight major industrial groups. Data for individuals and partnerships could not be separated into these industrial groups, but it is probably safe to say that nearly all large enterprises are to-day conducted under the corporate form of organization. The data in Table 9 have significance for many economic problems. One might note, for example, the severity of the 1921 depression in reducing the number reporting in mining, manufacturing, and trade, while affecting but little the transportation and public utilities and finance groups. But for the immediate purpose, the significant conclusions are the relative importance of the various industrial groups and the groups which appear to be increasing most

TABLE 9.—NUMBER OF CORPORATIONS REPORTING NET INCOME IN EXCESS OF $100,000, 1918 AND 1920 TO 1926

	1918	1920	1921	1922	1923	1924	1925	1926
Agriculture	80	91	40	67	92	73	84	80
Mining	605	1,039	309	492	436	328	451	495
Manufacturing	5,592	5,137	2,456	4,585	5,339	4,248	4,948	4,765
Construction	135	132	77	157	172	194	276	277
Transportation and public utilities	583	597	544	684	777	738	789	818
Trade	1,551	1,377	777	1,442	1,804	1,496	1,743	1,543
Public service	80	207	149	232	277	285	351	406
Finance	742	1,072	938	1,155	1,244	1,447	2,055	1,913
Not defined	266	85	40	50	65	37	42	3
Total	9,634	9,737	5,330	8,864	10,206	8,846	10,739	10,300

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[9] The rates by which corporation incomes were taxed were: 1918, 12 per, cent; 1919–1921, 10 per cent; 1922–1924, 12½ per cent; 1925, 13 per cent; 1926–27, 13½ per cent.

rapidly. Manufacturing appears to contain approximately one-half of these large enterprises, with finance second, and trade third. But the number included in manufacturing has not been gaining in recent years, while trade records a slight increase and finance companies have more than doubled in number during the period. The outstanding gain has been made in the smaller group called public service, which includes the electric light and power companies. The 1927 records are not yet available, but preliminary returns indicate a further decline in the grand total for the year.

In the case of manufacturing, it is possible to subdivide these corporations into eleven industrial groups. Their records follow.

TABLE 10.—NUMBER OF CORPORATIONS ENGAGED IN MANUFACTURING REPORTING NET INCOME IN EXCESS OF $100,000, BY INDUSTRIAL GROUPS, 1918 AND 1920 TO 1926

	1918	1920	1921	1922	1923	1924	1925	1926
Food products	695	401	358	496	540	591	566	567
Textiles	1,275	793	562	907	909	559	723	571
Leather	187	122	97	162	120	107	118	123
Rubber	73	35	3	50	45	49	70	50
Lumber	354	687	144	478	616	381	424	369
Paper	199	346	89	157	210	174	202	197
Printing and publishing	114	279	198	247	252	252	292	320
Chemicals	428	346	203	430	376	378	479	504
Stone, clay, and glass	135	234	136	215	330	247	250	257
Metal	1,666	1,377	437	936	1,354	1,236	1,550	1,508
All other	466	517	229	507	587	274	274	299
Total	5,592	5,137	2,456	4,585	5,339	4,248	4,948	4,765

The various branches of manufacturing industry have not fared alike during the period. Of the eleven groups, five reached their high point in 1918, two in 1920, two in 1923, and two in 1926. Chemicals and printing and publishing were the only industries to record their peak in 1926. However, the number reporting in the metals group increased steadily from 1921 to 1925, and now represents nearly one-third of the concerns included. These large concerns do not appear to be unduly concentrated in any particular field, but are widely scattered through the various groups.

Mergers.—There has been so much talk recently of mergers and consolidations, of "the era of consolidation,"[10] that some evaluation of the movement becomes imperative.[11] On the assumption that the majority of these events receive public notice, we have gone to the records of corporate and industrial news. From various sources, over 16,000 items were clipped relating to changes in the control of concerns.[12] These have been carefully studied to obtain the figures which follow.

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[10] See Paul Mazur, *American Prosperity*, 1928.

[11] "It is inevitable that the business of the country shall be done by very large companies which reach back to the source, and, taking the raw material, carry it through the necessary processes to the finished state." Henry Ford and Samuel Crowther, *Today and Tomorrow*, 1926.

Many consolidations have taken place in fields other than manufacturing and mining, to which the tabulation was limited. Numerous reports indicated a decided tendency toward vertical integration in the motion-picture industry, where theaters have been grouped in chains, which have in turn come under the control of the film distributor, and finally of the film producer.[13] There was also a marked tendency toward the building up of chains of retail stores, and the combining of these chains into larger chains. The tabulation does not include the merging of control of department stores or hotels, though there were a number of important consolidations in these fields. Furthermore, there are many instances of the extension of corporate control beyond the boundaries of the United States, but they have all been disregarded. In the field of railroads, important mergers have been attempted, but the Interstate Commerce Commission, endeavoring to obey the instructions of the Transportation Act of 1920, has greatly hampered and even checked such developments. In the field of banking, the annual report of the Federal Reserve Board reports steady increase in mergers and consolidations. The number of mergers affecting capital resources of member banks (*Annual Report*, Federal Reserve Board, 1927, p. 31) are as shown in the following statement:

1919	80	1924	124
1920	77	1925	120
1921	104	1926	154
1922	125	1927[14]	259
1923	120		

The number of banks affected is, of course, considerably greater than this number of mergers.

In tabulating the material, certain difficulties arose.[15] The criterion used was "Has there been any concentration of control?" "Are fewer concerns independent as the result of the event?" In the case of mergers, the facts are clear. Several concerns have passed into the hands of a new corporation organized for the purpose. But the record of acquisitions is not as simple. In many cases, it was clearly the same in significance as a merger—with the difference that one of the original companies persisted. The difficulty of definition appeared in the instances in which one company purchased the plant and assets of another because the other was going out of business, anyway. Many acquisitions were made at receivers' sales. An attempt was made to eliminate all such acquisitions, but in some instances the material at hand was too scanty to indicate the facts. The results of the tabulation are given in Table 11.

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[12] The chief source was the elaborate clipping collection published in the Standard Daily Trade Service.

[13] "Perhaps 5,000 of the total 20,000 motion-picture houses in this country are now owned or operated by the large producers and distributors." J. Homer Platten, "Motion Pictures—A New Public Utility," *The Bankers Magazine*, October, 1926.

[14] The number of mergers in 1927 was undoubtedly affected by the amendment to the Federal Reserve Act of February 25, 1927, which permitted the direct consolidation of state banks and national banks with trust companies.

[15] Concerning the tabulation of mergers and acquisitions in the mining and manufacturing field, no pretense is made that the record here given is complete. Many consolidations may never have reached the public press or the trade journals. Many transfers of control doubtless have been kept secret. However, there is no reason to

It is unfortunate that no measure of mergers and acquisitions can be obtained other than the number of concerns involved. Certain of the instances involve the largest industrial enterprises in the country, while others refer to small and local manufacturing establishments. In at least three months, indicated by a footnote in the table, the figures, on the basis given, are distorted because mergers were consummated involving a large number of small concerns.

Not too much confidence can be placed in the timing of these records of mergers. The date at which announcement reaches the public is often far behind the date of actual merging. On the other hand, many mergers are reported as completed when the stockholders' vote has not yet been taken. However, taking the timing, as given, to be approximately correct, it is important to note two things. First, the marked increase in mergers and in the number of concerns involved in mergers in the last three years. The net number of concerns disappearing, which is perhaps the most useful criterion of the movement, has risen since 1922. The number of acquisitions has not increased as rapidly as the number of actual mergers. Second, the marked cyclical fluctuation of the data. The consolidation movement appears to be most active in periods of prosperity, and to show a marked decline during depression. That the excitement of 1920 included an extraordinary number of

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believe that journalists are more astute at one time than at another, nor that business men are more secretive, and so we can assume, with some justification, that the records will indicate the trend if not the absolute amount of the movement. A number of instances were included where control passed through the acquisition of voting power. Mergers of subsidiaries, a rather common occurrence, were not included, since they do not represent any real change in control. Nor was the formation of new subsidiaries, a very active practice during the period, included as a merger. Furthermore, mergers and consolidation involving foreign concerns were not included, though there were many such in the records. There were many mergers proposed which were never consummated. The clippings would often indicate the original plan, later the directors' action, later the stockholders' vote, and finally the plan put into effect. The number of concerns which entered into this process, but never reached the last stage, is enormous. Merger talk without consummation was particularly evident in the years 1926 and 1927.

TABLE 11.—MERGERS AND ACQUISITIONS IN MANUFACTURING AND MINING, BY QUARTERS, 1919–1928

Quarter	1919	1920	1921	1922	1923	1924	1925	1926	1927	1928
	Number of mergers recorded									
First	12	44	25	20	18	23	26	41	40	44
Second	21	38	23	17	15	20	31	30	58	67
Third	34	49	16	15	11	28	26	36	56	49
Fourth	18	42	25	12	23	22	34	31	44	55
Annual total[a]	89	173	89	67	67	95	121	139	207	221
	Number of concerns merged									
First	44	135	[b]163	59	62	61	89	[b]242	116	138
Second	59	112	85	45	44	59	76	[b]151	211	234
Third	98	116	43	62	29	75	70	107	167	137
Fourth	83	111	82	47	83	62	84	93	152	158
Annual total[a]	292	474	373	220	218	263	333	597	678	687
	Number of concerns acquired									
First	25	118	46	47	40	72	61	85	85	103
Second	44	112	37	25	38	32	59	115	94	148
Third	83	121	53	35	26	40	83	100	109	154
Fourth	60	97	65	41	45	45	125	84	105	158
Annual total[a]	235	459	203	156	160	200	342	398	399	572
	Net number of concerns disappearing[c]									
First	57	209	[b]184	86	84	110	124	[b]286	161	197
Second	82	186	99	53	67	71	104	[b]236	247	315
Third	147	188	80	82	44	87	127	171	220	242
Fourth	125	166	122	76	105	85	175	146	213	261
Annual total[a]	438	760	487	309	311	368	554	856	870	1,038

[a] Annual totals are larger than the sum of the quarterly figures, because they include a small number of events which could not be more definitely placed within the year.

[b] Includes one merger of more than 60 concerns

[c] Number of concerns merged plus number of concerns acquired less number of new corporations formed

mergers and acquisitions is indicated by the data. The peak was reached in the first quarter of 1920 in the net number of concerns disappearing. The recovery did not come until somewhat after the general revival, 1923 being but slightly above 1922. The net number of concerns disappearing increased rapidly in the last quarter of 1923 and first quarter of 1924, but then, in sympathy with general business, declined during the rest of 1924. Since that time, the movement has grown by leaps and bounds. The record of mergers and acquisitions, by industries, is given in Table 12.[16]

It is evident that styles change in mergers and acquisitions as in everything else. The oil group was greatly in evidence in 1920, but has since passed from the picture, while the foodstuffs group has increased steadily. The year 1928 saw a surprising increase in mergers in the textile and chemical industries. The greatest tendency to consolidation at present, however, is in the foodstuffs group, as independent dairies, cheese factories, and bakeries are absorbed by the leading companies. However, the iron, steel, and machinery group has clearly the supremacy. It has accounted for about one-fifth of all mergers and acquisitions in mining and manufacturing since 1919.

The trend is clearly upward. The number of mergers is increasing steadily. The movement is not limited to a small number of industries, but is general. The motto has been accepted "In union there is strength," and consolidation is proposed as the remedy for all evils. An example of this trust in the merger, as a way out, is that of two California oil companies who planned to merge and, in fact, announced the plan early in 1927, but were both in the hands of a receiver before the merger was completed. On the other hand, many of the mergers represent a realignment of industry which should result in cheaper and more efficient production.

The most conspicuous trend toward consolidation in recent years has been in the field of public utilities. The development of holding companies with vast networks of subsidiaries has received considerable publicity and at least two investigations by the Senate of the United States. Probably the whole story cannot be learned, even by such practiced investigators. However, the general trend is evident from a tabulation made from the files of the *Electrical World.*[17] This trade paper collects and publishes news concerning the industry, and for the last three years has published each year in an early issue a list of the mergers and acquisitions of the previous year. These annual tabulations have

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[16] The groups are very comprehensive. Oil includes both petroleum mining and refining. Iron and steel includes the manufacture of products which are chiefly iron, such as farm implements, machinery, etc. Nonferrous includes smelting and refining, as well as the manufacture of products from nonferrous metals such as brass and bronze, and also clay products. Textiles includes rugs and felt hats, as well as dyeing and finishing textile products. Motor vehicles includes the manufacture of automobile parts, except tires. Chemicals includes paint and varnish, perfume, etc. In cases where concerns in two groups merge, the one which apparently dominates is used for classification.

[17] This source was suggested in a speech made by Hon. Thomas J. Walsh in the Senate of the United States, February 28, 1927.

TABLE 12.—MERGERS AND ACQUISITIONS IN MANUFACTURING AND MINING, BY INDUSTRIES, 1919–1928

	1919	1920	1921	1922	1923	1924	1925	1926	1927	1928	Total
	Number of mergers recorded										
Oil	15	35	16	11	9	9	8	7	7	7	124
Coal	4	7	6	5	8	11	5	5	3	4	58
Iron and steel	24	42	9	15	13	27	25	23	57	35	270
Nonferrous	6	6	12	5	5	6	15	25	22	19	121
Textiles	4	8	8	6	6	9	7	11	9	36	104
Motor vehicles	8	12	7	5	5	4	9	6	5	6	67
Chemicals	1	5	4	3	3	6	2	8	8	19	59
Foodstuffs	8	16	9	5	8	7	13	14	25	23	128
Lumber and paper	3	10	8	4	1	2	6	12	25	20	91
Other	16	32	10	8	9	14	31	28	46	52	246
Total	89	173	89	67	67	95	121	139	207	221	1,268
	Number of concerns merged										
Oil	40	98	49	34	35	28	16	20	22	20	362
Coal	25	26	28	25	25	31	12	24	12	10	218
Iron and steel	56	108	21	38	33	78	57	54	158	87	690
Nonferrous	21	20	30	14	17	13	38	[a]249	79	57	538
Textiles	12	19	19	18	15	24	26	28	30	93	284
Motor vehicles	16	33	16	25	13	9	20	13	16	15	176
Chemicals	2	26	14	6	9	14	11	32	23	56	193
Foodstuffs	28	38	54	15	37	26	50	47	114	128	537
Lumber and paper	8	21	[b]122	12	3	7	14	40	72	52	351
Other	84	85	20	33	31	33	89	90	152	169	786
Total	292	474	373	220	218	263	333	597	678	687	4,135
	Number of concerns acquired										
Oil	34	86	47	29	24	15	43	68	21	36	403
Coal	3	18	7	2	5	6	13	5	11	8	78
Iron and steel	50	110	48	39	44	48	70	80	100	85	674
Nonferrous	10	36	17	14	10	16	35	47	35	39	259
Textiles	21	27	15	5	10	18	26	24	20	55	221
Motor vehicles	23	37	19	13	15	8	19	15	14	28	191
Chemicals	8	23	9	18	6	9	14	16	19	40	162
Foodstuffs	30	26	9	14	12	36	43	50	67	139	426
Lumber and paper	9	26	9	4	6	12	9	21	30	33	159
Other	47	70	23	18	28	32	70	72	82	109	551
Total	235	459	203	156	160	200	342	398	399	572	3,114
	Number of concerns disappearing										
Oil	59	149	80	52	50	34	51	81	36	49	641
Coal	24	37	29	22	22	26	20	24	20	14	238
Iron and steel	82	176	60	62	64	99	102	111	201	137	1,094
Nonferrous	25	50	35	23	22	23	58	[a]271	92	77	676
Textiles	29	38	26	17	19	33	45	41	41	112	401
Motor vehicles	31	58	28	33	23	13	30	22	25	37	300
Chemicals	9	44	19	21	12	17	23	40	34	77	296
Foodstuffs	50	48	54	24	41	55	80	83	156	244	835
Lumber and paper	14	37	[b]123	12	8	17	17	49	77	65	419
Other	115	123	33	43	50	51	128	134	188	226	1,091
Total	438	760	487	309	311	368	554	856	870	1,038	5,991

[a] Includes two mergers of over 60 concerns.

[b] Includes one merger of over 60 concerns.

been used for the last four years, and, prior to that time, the various weekly issues have been combed for information concerning the disappearance of companies through their merging or being acquired by other companies. The results of this investigation appear in Table 13.

TABLE 13.—MERGERS AND ACQUISITIONS IN THE FIELD OF PUBLIC UTILITIES, 1919–1928

Quarter	1919	1920	1921	1922	1923	1924	1925	1926	1927	1928
	Number of companies disappearing									
First	3	1	11	27	118	171	70	325	214	245
Second	8	8	9	47	76	139	94	261	308	189
Third	9	5	29	86	121	157	112	253	153	151
Fourth	2	1	25	125	106	108	99	186	221	...
Annual total[a]	22	15	74	285	426	580	402	1,029	911	..

[a] Includes cases with month not known 1923, 5, 1924, 5, 1925, 27, 1926, 4, 1927, 15, 1928, 17

During the early part of the period, although there were few actual acquisitions, there were a number of interconnections formed whereby neighboring companies pooled their facilities. But the movement toward centralization began in the last half of 1921. Except for a slight setback in the last quarter of 1924 which lasted through 1925, the tendency continued at an increasing rate. In 1926, the astounding number of 1,029 concerns merged or were acquired by other companies. In the third quarter of 1927, the activity subsided somewhat, possibly from fear of the threatening investigation by the Government, and also from the increasing scarcity of raw material to be acquired or with which one could merge.

Of the concerns acquired in 1926, 201 were plants which had been operating under municipal ownership, and in 1927, 182 municipalities sold their utilities to private concerns.

Under	$10,000	22
$10,000 to	$50,000	72
$50,000 to	$100,000	34
$100,000 to	$250,000	40
$250,000 to	$500,000	22
$500,000 to	$1,000,000	18
$1,000,000 to	$2,000,000	21
$2,000,000 to	$5,000,000	19
$5,000,000 to	$10,000,000	13
$10,000,000 to	$20,000,000	15
$20,000,000 to	$50,000,000	18
$50,000,000 to	$100,000,000	8
Over	$100,000,000	2
Total		304

Some indication of the size of the concerns involved in these transactions is afforded by the record of about three-fourths of the companies in 1925 according to their capitalization. The foregoing statement shows the number of companies merged or purchased, grouped according to capitalization in 1925. That the mergers are not entirely among the small concerns, is indicated by the foregoing statement, and by the fact that 54 of the mergers in 1927 were mergers of holding companies, taken over by other larger companies.

III. THE SCALE OF PRODUCTION AND COSTS

In attempting to determine the significance of recent trends in the structure of industry, one might adopt numerous criteria. These range from the effect of large production and large-scale management upon invention and originality, to the possible influence upon market price. For the purpose of this study, it has seemed wise to confine the investigation to two strictly economic criteria. The first is the effect upon cost of production, discussed in this section, and the second is the effect of concentration upon the stability of our economic life.

The advantages of large-scale production are presented in too many other sources to make valuable any detailed discussion of them at this point. But it is important to point out the often neglected truth that in large sections of industry, most efficient production is necessarily on a small scale. Some of the general types of industry in which small-scale production is required are:

1. Industries in which products cannot be standardized and establishments which make products to suit the differing tastes of consumers. Such industries produce tailored suits, high-grade furniture, art goods and finely bound books.
2. Industries producing for a small market, such as those manufacturing artists' materials and nets and seines.
3. Industries in which the local market is small and whose product has a high transportation cost. In the manufacture of artificial-stone products, or bricks, the activity can seldom be on a large scale because of the limited local market and the high cost of transportation.
4. Industries in which the material used is widely scattered and cannot be concentrated because of high transportation cost or perishability. Cheese factories and cider mills may be included in this class.
5. Industries in which skilled labor is the chief element, such as engraving and job printing, whose products are really services rather than commodities.[18]

One may recognize these special cases in which small-scale production is necessary, but still hold to the belief that, in general, large-scale production is more economical. There are unquestionably many potential economies present in large-scale production and large-scale operation. On the other hand, there is the increased burden of administrative machinery, control, and supervision. If these potential economies prove to be real net economies, the larger concerns should report lower costs and higher profits.

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[18] Willard L. Thorp, *The Integration of Industrial Operation*, p. 89.

Costs of plants arranged according to size have been recently reported by the Federal Trade Commission,[19] for the baking industry. Since this field is one in which consolidations have been numerous, it is particularly significant for our study. Cost figures were obtained by the Commission and reduced to a per pound basis. The data presented in Table 14 refer to plants doing an exclusively wholesale business, thus eliminating those which carry on a house-to-house business as well. The results are for 628 plants during the period 1922 to 1925.

TABLE 14.—COSTS, IN CENTS PER POUND, OF BREAD FOR EXCLUSIVELY WHOLESALE BAKING PLANTS, BY SIZE GROUPS, 1922–1925

Production, pounds per year	Ingredients cost	Manufacturing expense	Selling and delivery expense	General and administrative expense	Total cost	Cost excluding ingredients
Under 5,000,000	3.25	1.87	1.60	0.36	7.08	3.83
5,000,000 to 10,000,000	3.20	1.79	1.67	0.27	6.94	3.73
10,000,000 to 15,000,000	3.12	1.65	1.58	0.24	6.59	3.47
15,000,000 to 20,000,000	3.11	1.55	1.49	0.21	6.37	3.26
20,000,000 to 25,000,000	3.21	1.58	1.48	0.22	6.49	3.28
25,000,000 to 30,000,000	3.28	1.59	1.50	0.16	6.53	3.25
30,000,000 to 35,000,000	3.20	1.59	1.62	0.16	6.56	3.37
Over 35,000,000	3.33	1.96	1.56	0.15	7.00	3.67

The cost excluding ingredients is a better criterion than total cost. In the first place, different kinds of bread require different ingredients, and no distinction has been made between types. Secondly, the largest bakeries tend to be in the East, at the greatest distance from the flour milling centers, resulting in additional apparent cost of ingredients. From these data, the Federal Trade Commission draws the conclusion that "costs are on the whole lower for the larger than for the smaller-sized plants. There is some indication that plants of a size a little below the largest may be somewhat lower in cost." However, the results for the largest-size group are probably conditioned less by the size of the plants than by the difference in the costs of the Ward Baking Corporation, the General Baking Corporation, and the Continental Baking Corporation, which dominate the groups above 15 million pounds. In general, their costs appear to be higher, although within the organizations the largest plants of Ward and General have the lowest cost, while, for the Continental Baking Corporation, the records indicate the lowest cost in the 15 to 20 million pound group.

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[19] United States Federal Trade Commission, *Competition and Profits in Bread and Flour* (70th Cong. 1st Sess., Sen. Doc. No. 90). Washington, 1928.

Cost records have also become available recently for the merchant blast furnace industry. In reporting its investigation into this industry, the Bureau of Labor Statistics says:

> Furnace performance is determined by other factors than mere size of stack. It seems clear that stacks of medium size have a distinct advantage as a smelter over the extremely large stack. No matter how efficiently the large stacks are run, they cannot turn out pig iron proportionately to their size in comparison with efficiently operated stacks having a volume of 12,000 to 18,000 cubic feet . . . Large furnaces and hard driving necessarily go together. Increased stack size beyond a certain limit appears to make possible greater output only at the expense of good control of materials.[20]

The records for bakeries and blast furnaces are not presented as significant in themselves. There may be considerable doubt concerning the nature of the samples studied and the method used. But the important matter is that both confirm the well-established principle that, at any given time and with any given stage of the industrial arts, there appears to be a size of plant which is most efficient. Technical improvements, changed relationship between the cost of capital and of labor, and altered markets may all serve to change this figure. Certainly the records in the preceding pages concerning the scale of production indicate tremendous increases in the size of plant during the last few years. Probably our technical advance has pushed the point of diminishing returns farther up the scale, but the fact still remains that such a point exists.

IV. THE SCALE OF OPERATION AND COSTS

While the above records are extremely significant for the analysis of large-scale production, they do not indicate the gains which consolidation may yield.[21] To answer this question, the records for the baking industry are tabulated according to whether the plant is a single, lone enterprise, or is a member of a multiple group.

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[20] United States Bureau of Labor Statistics, *Productivity of Labor in Merchant Blast Furnaces.* Bulletin No. 474. Washington, 1928.

[21] An examination by Prof. A. S. Dewing of the results of the consolidation period of about 1900 (*Quarterly Journal of Economics*, Vol. 36, p. 84) indicates that, for thirty-five consolidations formed prior to 1904, the earnings of the constituent independent companies for the year prior to the consolidation exceeded the earnings of the following year by 18 per cent, and exceeded the results of the tenth year after consolidation by 22 per cent. Dewing summarizes this to say, "In brief, the earnings of the separate plants before consolidation were greater than the earnings of the same plants after consolidation."

Various studies made by the Federal Trade Commission examine costs and earnings during the period 1913–1922. Of sixteen industries, in but four was the rate of return on investment in the largest concerns up to the general average for the industry, while in ten instances, the group of smallest concerns, reported earnings above the average.

TABLE 15.—COMPARATIVE COSTS, IN CENTS PER POUND, EXCLUDING INGREDIENTS FOR EXCLUSIVELY WHOLESALE PLANTS OF SINGLE AND MULTIPLE PLANT COMPANIES, BY SIZE GROUPS, 1922–1925

Production, pounds per year	Single	Multiple
Under 5,000,000	3 58	3 97
5,000,000 to 10,000,000	3 79	3 69
10,000,000 to 15,000,000	3 48	3 47
15,000,000 to 20,000,000	3 72	3 20
20,000,000 to 25,000,000	3 14	3 30
25,000,000 to 30,000,000	3 10	3 30

In analyzing the data, the Federal Commission says, "Plants of multiple-plant companies have lower ingredient costs and general and administrative expense, whereas the single-plant companies have lower manufacturing and selling and delivery costs." And as a final conclusion, it says, "from these figures, there is but little to indicate that the result of combining the plants of wholesale baking companies into a single organization is a lower cost per pound of bread produced."

The second inquiry relates to flour milling, an activity which has been under the scrutiny of the Federal Trade Commission for some time. The report mentioned above brings the record up through the year 1924. The records are in terms of capital investment and net income.[22] By size groups, the results for 90 companies for 1923 and 1924 are shown in Table 16. As a result of this investigation, the Federal Trade Commission states that "companies of medium size show slightly higher rates of profit than either the larger or the smaller companies." That

TABLE 16.—RATE OF RETURN ON CAPITAL INVESTED FOR 90 FLOUR MILLING COMPANIES, BY AMOUNT OF INVESTMENT AND PRODUCTION, 1923 AND 1924 COMBINED

Classed by amount of investment	Rate of return	Classed by amount of production	Rate of return
	Per cent	*Barrels*	*Per cent*
Under $250,000	6.6	Under 125,000	6.8
$250,000 to $500,000	8 9	125,000–250,000	5 2
$500,000 to $1,000,000	9.9	250,000–500,000	9.4
$1,000,000 to $2,000,000	4 2	500,000–1,000,000	7 8
Over $2,000,000	7.0	Over 1,000,000	7.1

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[22] Capital investment is the sum of capital stock, surplus, nonoperating reserves, and borrowed money less outside investments. Net income is the net return before deducting bond interest and Federal taxes plus interest paid on borrowed money less income from outside investments.

this is not a new development, but has persisted for some time, is indicated by the records for 47 milling companies since 1919.

TABLE 17.—RATE OF RETURN ON CAPITAL INVESTMENT FOR 47 FLOUR MILLING COMPANIES, GROUPED BY QUANTITY OF PRODUCTION BY YEARS, 1919–1924

Production group	1919	1920	1921	1922	1923	1924
	Per cent	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*
Under 125,000 barrels	15 4	7 8	−3 2	9 3	4 3	7 0
125,000 to 250,000 barrels	14 0	9 1	−3 4	8 0	4 7	3 0
250,000 to 500,000 barrels	18 0	21 1	5 4	12 9	12 8	11 6
500,000 to 1,000,000 barrels	11 0	18 3	−7 6	8 4	3 3	7 7
Over 1,000,000 barrels	13 7	16 2	7 8	8 6	8 5	6 7

In every year but one, and that was 1921, the middle-sized group reported the highest rate of return. In that year the largest companies were at the top. In other years the largest companies were second once, third twice, and fourth twice.

A survey of the petroleum industry made by the Federal Trade Commission[23] throws a faint ray of light on the problem. The report is based upon data collected directly from the companies by the Commission. For our purpose, the most significant material is that pertaining to the profits of companies according to their size. They are grouped according to amount of capital investment. Briefly, this capital investment is the total credited to stockholders plus long-term borrowings minus outside investments. It represents, as closely as can be obtained from the accounts, the investment of capital in the petroleum activities of the company. To correspond to the figures for investment, reports concerning net income were obtained from the companies.[24] The results shown in Table 18 pertain to companies engaged solely in crude petroleum production.

During the entire period, and each year singly, the size group, $5,000,000 to $25,000,000, reported the highest return. For the period of four

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[23] United States Federal Trade Commission, *Petroleum Industry Prices, Profits, and Competition* (70th Cong., 1st Sess., Sen. Doc. No. 61) Washington, 1928.

[24] The capital stock plus surplus plus nonoperating reserves is called "company investment" by the Federal Trade Commission. To this are added long-term borrowings and advances from associated and affiliated companies minus outside investments, such as stocks and bonds of other companies, United States Government bonds, etc. A further correction was made for surplus arising out of discovery of new wells, where the fair market value of the property is disproportionate to the cost. Discovery value was omitted from the figure for investment. The net income was obtained by adding to income before payment of bond interest and Federal taxes, the interest paid on long-term borrowings, including amortization, and deducting income from outside investments. In certain cases, surplus adjustments were made to cover such items as fire losses, and profit or loss on sale of salvaged equipment. Furthermore, the depletion charges against value were omitted from costs.

TABLE 18.—PER CENT RETURN ON CAPITAL INVESTMENT FOR COMPANIES ENGAGED SOLELY IN CRUDE PETROLEUM PRODUCTION, BY SIZE GROUPS, 1922–1926

Investment group	1922	1923	1924	1925	1926[a]
Number of companies	77	84	90	90	51
	Per cent				
Under $1,000,000	1.6	8.3	14.3	13.4	5.3
$1,000,000 to $5,000,000	6.6	4.3	7.1	16.4	16.7
$5,000,000 to $25,000,000	10.7	23.2	24.4	51.9	19.1
Over $25,000,000	3.7	3.7	7.8	15.5	18.2

[a] First six months on an annual basis

full years, 1922–1925, the largest companies show the lowest average rate of return. However, it is perhaps important to note the steady advance made by this group, so that for the first half of 1926 it challenged the smaller concerns for leadership.

A parallel study for companies engaged in refining is less conclusive because of the fact that many companies were engaged in producing and marketing as well. Using the same definitions of net capital investment and net income, the reports by size groups are shown in Table 19. The results are less clear than those for producing companies. For the four years, 1922–1925, the most profitable group on the average is next to the smallest in size, while the least profitable is the smallest group. The largest companies occupy a position exactly in the middle. The figures for the first six months of 1926 are so different from those of the earlier years that either it was an extraordinary period or the data are insufficient. The largest companies are the most prosperous, while the middle group, the leaders in the previous year, drop to last place.

TABLE 19.—PER CENT RETURN ON CAPITAL INVESTMENT FOR COMPANIES ENGAGED IN PETROLEUM REFINING, BY SIZE GROUPS, 1922–1926

Investment group	1922	1923	1924	1925	1926[a]
Number of companies	58	60	63	63	54
	Per cent				
Under $1,000,000	7.4	−14.2	−6.3	3.5	13.0
$1,000,000 to $5,000,000	15.2	12.3	11.0	5.7	10.5
$5,000,000 to $25,000,000	11.7	3.5	9.8	11.5	7.5
$25,000,000 to $100,000,000	9.7	3.6	6.8	10.6	11.7
Over $100,000,000	9.8	6.7	8.6	11.3	13.2

[a] First six months on an annual basis

This collection of data may be used to throw light on still another problem, that of integration, *i.e.*, expansion into fields whose process either precedes or follows that already performed. The results for companies subdivided according to degree of integration are shown in Table 20. On the basis of these data, the companies may be ranked over the period in order of return on investment as follows: 1. Refining and marketing. 2. Producing. 3. Producing and refining. 4. Producing, refining, and marketing. 5. Refining.

TABLE 20.—PER CENT RETURN ON CAPITAL INVESTMENT FOR COMPANIES IN PETROLEUM INDUSTRY, BY DEGREE OF INTEGRATION, 1922–1926

Activity	1922	1923	1924	1925	1926[a]
Producing	5 9	7 5	9 7	18 6	17 9
Refining	13 5	−1 5	−0 1	5 5	8 1
Producing and refining	18 5	2 0	4 9	9 3	11 8
Refining and marketing	11 6	9 8	12 0	12 6	14 9
Producing, refining, and marketing	8 8	4 7	7 3	10 8	12 1

[a] First six months on an annual basis

No figures are available for companies engaged solely in marketing. The importance of the element of distribution is clearly seen. Refining, an activity which, when carried on alone, is the least productive of profits of the activities examined, moves to the top when coupled with marketing activities. If combined with producing activities, it is less successful, while the most fully integrated companies occupy middle ground. For the last 18 months, however, the producing companies have been in the lead. While, from the refiner's point of view, integration is highly desirable, it would not appear to have a favorable effect on the fortunes of producing companies. However, extension into the marketing field is evidently a great aid to profits.

While the above data for wholesale baking, flour milling, and the various branches of the petroleum industries, are by no means conclusive for industry as a whole, all are fields in which consolidations have been numerous, and in which the records, as given by the Federal Trade Commission, do not show significant net economies of large-scale operation.

V. SIZE AND THE VOLUME OF BUSINESS

According to the above results, the large concerns should not be faring any too well in the search for markets.[25] Economic analysis has usually predicated success upon ability to produce at low cost.

In order to determine whether or not the larger concerns have been faring successfully in various industries, a special tabulation (Table 21) was made from the manufacturing schedules gathered by the Bureau of the Census in 1923 and 1925.[26] As far as was convenient, industries were selected in which the concern and establishment were identical. All cases in which establishments reported in both years were segregated. They were then grouped according to size in 1923, and geometric averages were made of the relative changes between 1923 and 1925. The figures given are, therefore, averages of the movement of each group when every concern in the group is given equal weight.

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[25] There are some indications that, in industries which have been dominated by a single concern, almost to the extent of monopoly, the large concern has failed to maintain its position. Instances of this, cited by Watkins (*Quarterly Journal of Economics*, November, 1928) are the steel, sugar, paper, glass, and oil industries.

TABLE 21.—CHANGES IN VALUE OF PRODUCTS AND AVERAGE NUMBER OF WAGE EARNERS EMPLOYED FOR IDENTICAL ESTABLISHMENTS IN NINE INDUSTRIES, BY SIZE OF ESTABLISHMENT, 1923–1925

Industry	Value of products			Wage earners		
	Large	Middle	Small	Large	Middle	Small
	Geometric average of relatives (1923 = 100)					
Belting, other than leather and rubber	105.9	[a]	[b]60.9	100.4	[a]	56.3
Carpets and rugs, wool	90.6	81.4	90.8	89.7	87.0	97.8
Clocks, etc.	98.77	98.75	134.7	94.3	101.0	99.1
Firearms	81.4	75.9	113.3	58.9	70.2	92.1
Hats, wool felt	94.7	88.3	101.3	92.8	104.7	105.1
Locomotives, excluding railroad repair shops	26.5	[a]	74.5	38.9	[a]	80.3
Matches	110.7	99.1	88.0	99.9	86.4	64.9
Pencils, lead	111.0	102.9	67.5	90.7	100.3	59.1
Pens, fountain and stylographic	90.5	83.8	[c]134.4	93.3	71.7	[c]100.7

[a] Establishments divided into only two groups.

[b] For comparison with figure for wage earners, 55.6 should be used, one more establishment being included in the tabulation of value of products than in wage earners.

[c] Includes one establishment whose value of products increased over 4,000 per cent and wage earners over 1,100 per cent. If eliminated, averages for remaining establishments in the group are 102.3 and 83.4.

The tabulation is not sufficiently comprehensive to be conclusive, but it is certainly provocative. The marked differences among the size groups warn against careless generalization about an industry, while the variations among the industries studied warn against talking of industry as a whole. The belting, match, and lead pencil industries are cases in which large-scale production is clearly tending to dominate. The small concerns are not keeping their share of the business done. In the six other industries, the smaller concerns have fared better than either of the other groups. However, there is an unfortunate bias created by the nature of the data which operates in favor of the smallest establishments. The tabulation includes only those establishments which reported in both census years. A large concern, if unsuccessful, will reduce its scale of operation; a small company in the same condition will go out of business and become ineligible for the tabulation So, while all successful small concerns are included, a smaller proportion of the less fortunate ones are included than is the case with the other size groups.

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[26] The computations were made by the author and no responsibility for the results may be attributed to the Bureau of the Census.

The bias mentioned above does not affect the record of the middle and large groups in any serious way. Consequently, it is a highly significant fact that in eight of the nine industries, locomotives being the exception, the large concerns have gained more than the middle-sized establishments. The locomotive industry is perhaps a special case, since the large companies manufacture standard railroad equipment, while the small concerns tend to make specialized products, such as mining locomotives.

This tendency for the large concerns to gain more than the middle group is emphasized by further tabulations for two industries where the "large" group may be subdivided into "very large" and "large" concerns. The average change in value of products is shown in the following statement:

	Very Large	Large
Carpets and rugs.	99 0	88 1
Pens, fountain	126 6	67 1

In both instances, the success of the very large companies is marked.

A certain similarity appears between the changes in value of products and wage earners. In general, an increase in value of products has a parallel relative increase in wage earners. However, while the large companies had gained more than the middle-sized in value of products in eight of the nine industries, they have increased their wage earners by a greater amount in but four of the nine. In other words, the large concerns have often gained in value of products without corresponding relative gains in wage earners. A possible explanation for this phenomenon is that the introduction of machinery has proceeded more rapidly in the large plants than in the middle-sized group.

Stock Price Data.—As a further approach to the problem, an attempt was made to determine the movement of stock prices for concerns within four industries grouped according to size. One must at once admit that the fluctuations of security prices are quite inexplicable, that countless factors influence their behavior, and that any discussion of this topic must be bound so tightly by assumptions as to bring it near to strangulation. But let us assume that the advance in security prices of a group of concerns within an industry, relative to the other concerns in the industry, indicates that that group is making more of a success of its business than the other concerns. It may indicate only that the investors believe this to be true. But in these days of investment services and brokerage house statisticians, there may well be some slight basis of fact for these

CHART 5.—INDEXES OF STOCK PRICES FOR CONCERNS IN THE RAILROAD EQUIPMENT INDUSTRY, BY SIZE GROUPS, QUARTERLY, 1918–1927

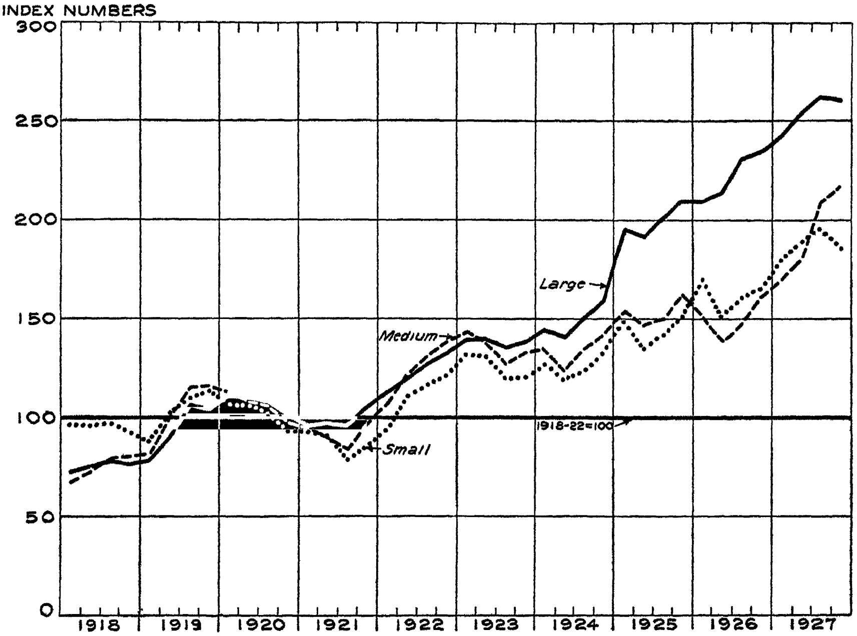


CHART 6.—INDEXES OF STOCK PRICES FOR CONCERNS IN THE IRON AND STEEL INDUSTRY, BY SIZE GROUPS, QUARTERLY, 1918–1927

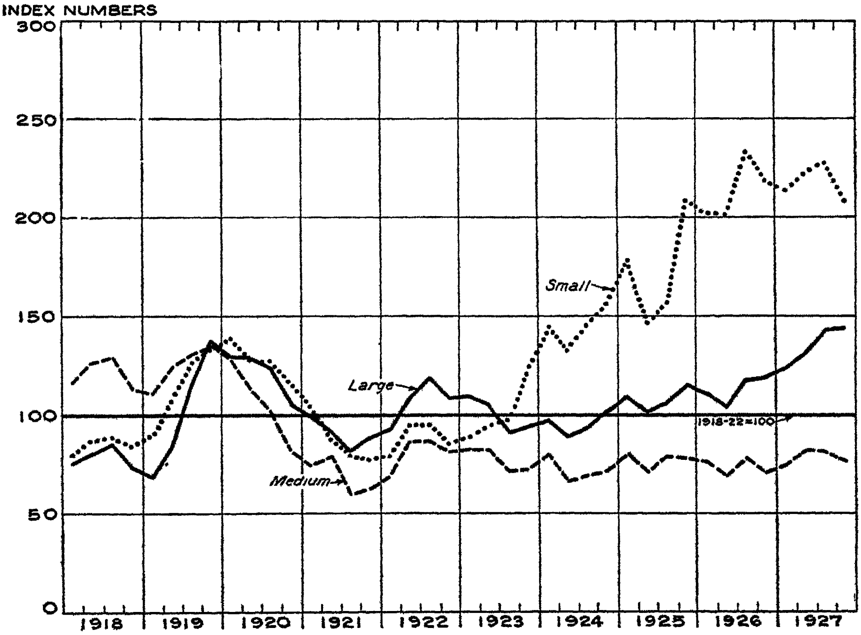


CHART 7.—INDEXES OF STOCK PRICES FOR CONCERNS IN THE NON-FERROUS METALS INDUSTRY, BY SIZE GROUPS, QUARTERLY, 1918–1928

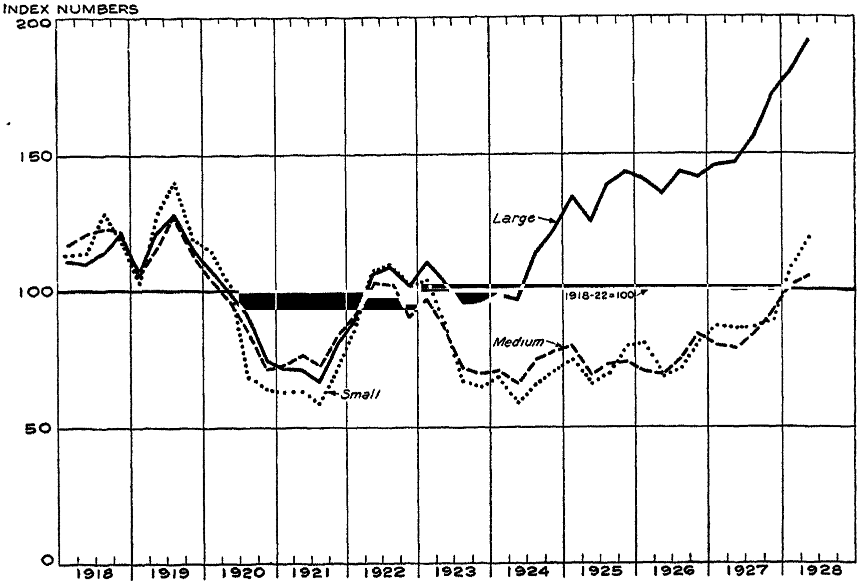
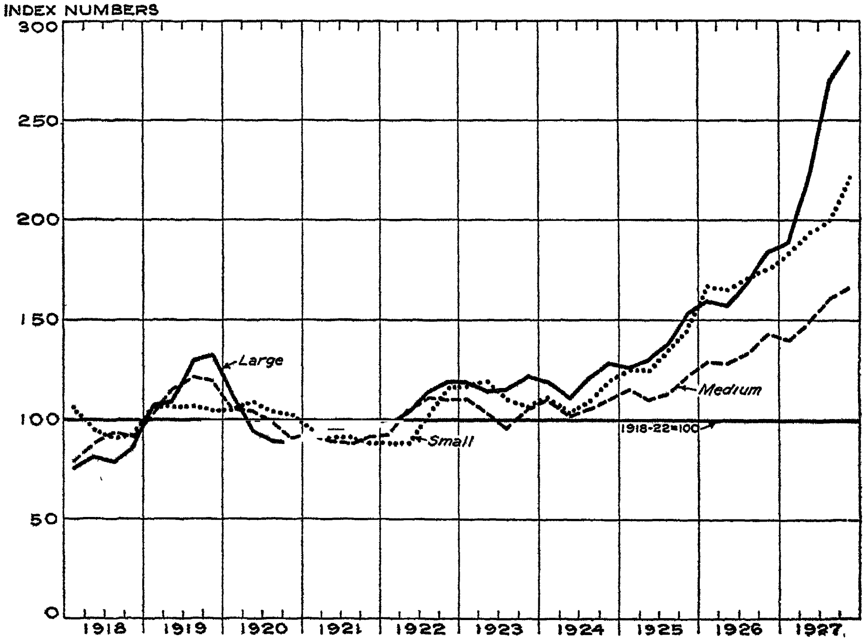


CHART 8.—INDEXES OF STOCK PRICES FOR CONCERNS IN THE TOBACCO INDUSTRY, BY SIZE GROUPS, QUARTERLY, 1918–1927



opinions. At any rate, the indexes have been constructed for four industries, and are presented in Charts 5, 6, 7, and 8.[27]

Except for the iron and steel industry, the various groups appear to move similarly until about the end of 1922. Then, the various size groups begin to separate. In the case of the railroad equipment group and the nonferrous metals, the large concerns rapidly pull away from the medium and small concerns, which remain fairly close together. In the tobacco industry, the small concerns keep pace with the large until the middle of 1926, but then the rapid advance in the large concerns leaves the small ones well behind. In the iron and steel industry, the small concerns are well above the other two groups, the medium-sized concerns having dropped below in 1921 and never having recovered. In summary, the large concerns are well in advance in three instances, and second in one. The medium concerns are definitely at the bottom in two cases and similar to the small concerns in two. They are the sufferers. Less extensive examination of other industries indicates much the same situation to be true, that the concerns just below the large companies are not enjoying the stock market advance of their leaders.

What does this situation mean? It may have any one of several explanations. It may indicate that the large concerns are finding the economies which the Federal Trade Commission figures for several years ago did not disclose at that time. It may indicate that the large concerns, because of modern methods and conditions of selling and distribution, are taking a larger and larger share of the nation's business, as was indicated by the record of individual establishments given above. This may be even at a higher cost than their competitors. Or finally, it may indicate that the same dogma, which expresses itself so often in mergers and consolidations—the belief in the universal advantages of size and large-scale production—is thus expressing itself in the valuation of corporation securities.

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[27] These indexes were constructed by Albert Abrahamson, instructor of economics, Bowdoin College. The data were obtained from the Standard Statistics Co., which placed its files at the disposal of the investigator and assisted in every way. R. B. Brownlee, of the Research Department of that company, gave much valuable advice.

The indexes are based upon records for all those concerns for which sufficient quotations were available during the period. For nine-tenths of the cases, quotations for the close of each week were used; the remaining being half the averages of monthly high and low and half of bid and asked. Corrections were made for stock dividends, rights, etc. Quarterly averages were computed from these quotations. These averages were then expressed in link relatives. The average of the median two or three link relatives was used to form a chained index, corrected so that 1918–1922 equaled 100. The size group was determined by examining the total market value of stock outstanding for the period 1918–1922.

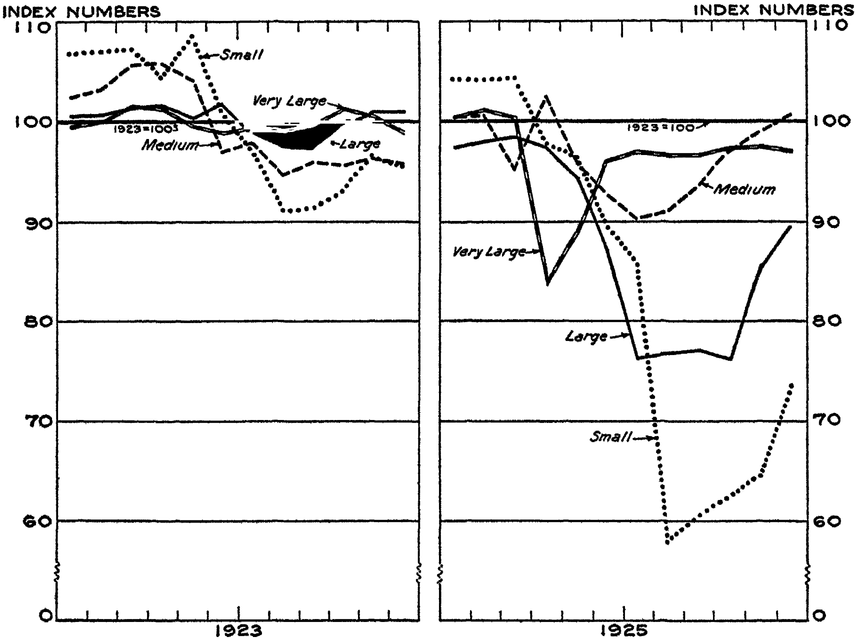
The use of link relatives, which are customarily scorned in constructing index numbers, has definite merit in this case. In the first place, it permits the addition and subtraction of concerns with ease; secondly, it does not carry over, as a permanent part of the computation, any sharp shift upward due to financing, etc. The use of medians is important in that it tends to eliminate the extreme movements in single securities due to the unexplained forces in the stock market.

VI. SIZE AND STABILITY

Business fluctuations are usually subdivided into four general categories: secular, cyclical, seasonal, and random variations. Of these four, material is available concerning the effect of increased concentration of industry upon two, the random and the cyclical fluctuations.

Random Fluctuations.—A special tabulation (Table 22) was made of three industries covered by the Census of Manufactures for the years 1923 and 1925. Establishments were selected which reported in both censuses. They were grouped into three or four size groups, and the monthly employment was calculated for each group. These were reduced to index numbers with 1923 equaling 100. The results are depicted in Charts 9, 10, and 11. It is evident that in the carpet and rug, and in the match industry, the large concerns are more stable from month to month. The medium-sized concerns show wider fluctuations, and the small show the most extreme variations. It must be remembered that these variations are compared on a percentage basis, so that an increase in a small concern from 8 to 12 workers is the equivalent of one

CHART 9.—INDEX NUMBERS OF WAGE EARNERS EMPLOYED BY MONTHS FOR IDENTICAL ESTABLISHMENTS IN THE CARPET AND RUG, WOOL AND OTHER THAN RAG, INDUSTRY, BY SIZE GROUPS, 1923, 1925



in a large concern from 1,000 to 1,500 wage earners. In the wool-felt hat industry, the seasonal fluctuations dominate the situation, and all size groups move through much the same seasonal fluctuations. The period covered is not one with any pronounced cyclical change, and these fluctuations must be regarded not as the behavior of these size groups throughout a major swing of a cycle, but as the ordinary chance fluctuations which continue at all times, the random variations. In Table 22 are shown the average number of points by which the various size groups in the three industries varied from month to month—the average of the differences between succeeding months without regard to size.

CHART 10.—INDEX NUMBERS OF WAGE EARNERS EMPLOYED BY MONTHS FOR IDENTICAL ESTABLISHMENTS IN THE MATCH INDUSTRY, BY SIZE GROUPS, 1923 AND 1925

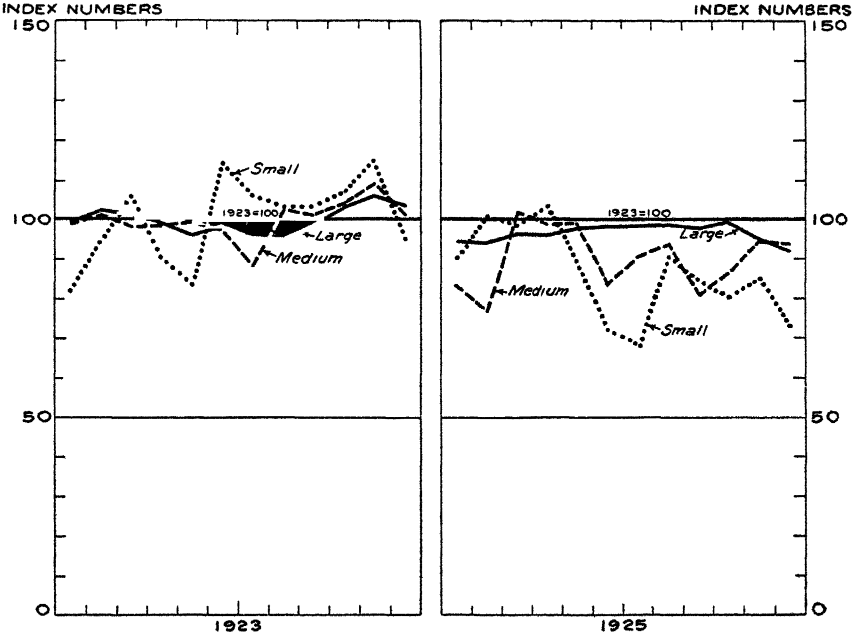
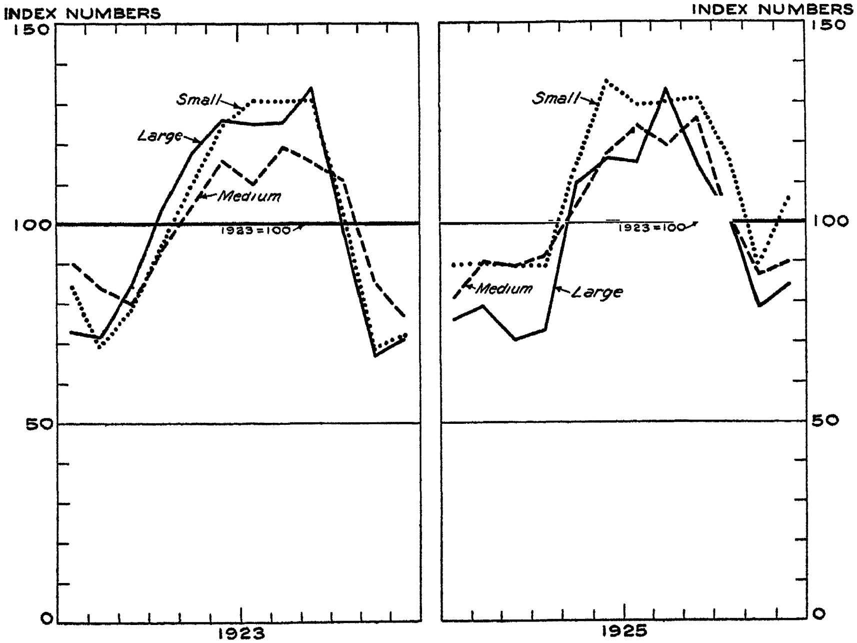


TABLE 22.—AVERAGE MONTH-TO-MONTH CHANGE IN INDEX NUMBERS OF EMPLOYMENT FOR THREE INDUSTRIES, BY SIZE OF ESTABLISHMENT, 1923 AND 1925

Industry	Very large	Large	Medium	Small
Carpets and rugs, wool	1 4	2.3	2.5	4.3
Matches		2 0	5.9	10.2
Wool-felt hats	. .	12 4	8.7	11.8

The records of the Federal Trade Commission throw considerable light on these random fluctuations. Most cases cover the war years, and

CHART 11.—INDEX NUMBERS OF WAGE EARNERS EMPLOYED BY MONTHS FOR IDENTICAL ESTABLISHMENTS IN THE WOOL-FELT INDUSTRY, BY SIZE GROUPS, 1923 AND 1925



cannot be regarded as subject to any marked cyclical fluctuations. In nearly all instances the variation in rate of return from year to year is greater among the small concerns. As an example, the record of the coke industry for the years 1915–1918 is given in Table 23.[28]

TABLE 23.—RATE OF RETURN ON INVESTMENT OF BEEHIVE COKE COMPANIES IN WESTERN PENNSYLVANIA, BY SIZE GROUPS, 1915–1918

Investment	Rate of return					Average deviation	Per cent deviation
	1915	1916	1917	1918	Average		
Over $5,000,000	5.7	11.9	24.3	18.3	15.0	6.2	41
$1,000,000 to $5,000,000	2.2	7.5	23.0	17.8	12.6	7.8	62
Under $1,000,000	7.9	16.6	57.3	69.8	37.9	25.6	68

The changes from year to year are not only largest in actual amount for the small concerns, but also greatest when expressed as percentages of the average. In order to demonstrate that this condition is not the result of selecting an instance in which the greatest profits were earned by the small companies, the record of the canned-milk industry is given in Table 24, an industry in which the highest return was recorded in the next to largest group.[29] In this case, as well, the widest fluctuations appear in the smaller size groups.

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[28] United States Federal Trade Commission, *War-Time Profits and Costs of the Steel Industry*. Washington, 1925.

TABLE 24.—RATE OF RETURN ON INVESTMENT OF CANNED-MILK COMPANIES, BY SIZE GROUPS, 1915–1918

Volume of sales	1915	1916	1917	1918	Average	Average deviation	Per cent deviation
Over $5,000,000	11.4	18.1	19.4	8.9	14.4	4.3	30
$1,000,000 to $5,000,000	23.8	30.6	30.6	12.0	24.2	6.4	26
$250,000 to $1,000,000	2.2	16.8	17.3	4.5	10.2	6.8	67
Under $250,000	−5.4	8.2	15.8	2.7	5.3	6.7	126

By the law of averages, there seems every reason for expecting a small concern to suffer wider fluctuations in its operation than a large concern. But it may furthermore be expected that the large concern will maintain steadier operation than an equivalent number of small concerns. The various small concerns will compensate for each other's fluctuations to some extent, but the large concern will have the advantage in being better able to plan ahead, to study its market, and to take advantage of regional differences in business conditions. Furthermore, while the various fluctuations of the small concerns may compensate for each other statistically, they do not do so economically. In each case the concern is required to maintain machinery and equipment sufficient to meet its maximum demand. The result is a total capacity greater than the single large company will find necessary. Finally, the wider fluctuations in the individual small companies will result in continual hiring and discharging of labor. Other small companies may stand ready to hire the man who has just been discharged, but unless a number of small companies are located in the same community, operation by small companies will tend to keep a larger number of men unemployed than when large companies dominate the industry.

Cyclical Fluctuations.—The Bureau of the Census destroyed the schedules for years prior to 1923, so that it was not possible to include the year 1921 in a study of industrial changes according to the size of concerns. An attempt was made to examine the relation between stability and the scale of production by correlating the various industries in terms of their average scale of production, and the degree to which their value of production in 1921 fell below the average of 1919 and 1923.

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[29] United States Federal Trade Commission, *Report on Milk and Milk Products.* Washington, 1921, p. 44.

No relationship was indicated. The industries which suffered most heavily were neither predominantly large-scale nor small-scale. Furthermore, the severity of the depression in the various industries was not related to the average number of workers per establishment, the horse power per establishment, or the percentage which wages bore to total expenses. If any such relationship exists, it must be in terms of the relative severity with which the depression attacks the various concerns within an industry rather than in determining the effect upon one industry as distinct from another.

The material which bears most directly on this problem, appears in *Employment Hours and Earnings in Prosperity and Depression*, by Dr. Willford I. King, National Bureau of Economic Research Publication Number 5. Reports of employment were collected from approximately 850 enterprises. The results of this inquiry are given in Table 25.

TABLE 25.—THE VOLUME OF EMPLOYMENT AT THE PEAK AND TROUGH FOR FACTORIES, 1920–1922

Employees per concern	Total number on payrolls reporting	Estimated hours actually worked (in millions)		
		Peak	Trough	Per cent decline
0 to 20	2,672	901	827	8 21
20 to 100	16,902	1,171	946	19 21
Over 100	562,305	5,327	3,273	38 56

These figures, while not based upon a large enough sample to be conclusive, are as yet unchallenged. They demonstrate that in terms of employment, cyclical fluctuations are most severe among large concerns.

However, these results do not appear consistent with the indexes of stock prices, depicted in Charts 5 and 9. In two of these industries, the securities of the large companies showed much less decline in 1921 than the other groups. In the other two the three groups move together. Furthermore, there are at least two investigations by the Federal Trade Commission which present data for earnings over this significant period. The first record is for slightly over 100 flour milling companies. The average rate of profit on the investment as determined by the Federal Trade Commission is given in Table 26.[30] There can be no question but that, in the above industry, the large concerns weathered the depression of 1921 more successfully, from a financial point of view, than did the small concerns. The same result appears in the figures which the Federal Trade Commission has published for the furniture industry.[31]

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[30] United States Federal Trade Commission, *Report on the Wheat Flour Milling Industry*. Washington, 1924, p. 37.

TABLE 26.—AVERAGE RATE OF RETURN IN THE FLOUR MILLING INDUSTRY, 1919–1922

Investment group	1919	1920	1921	1922
Over $2,000,000	13.7	15.8	2.0	11.5
$1,000,000 to $2,000,000	16.8	14.1	−.7	5.9
$500,000 to $1,000,000	18.4	15.7	−3.1	12.0
$250,000 to $500,000	15.5	10.6	.7	10.0
Under $250,000	18.5	.8	−9.4	6.5

TABLE 27.—AVERAGE RATE OF RETURN IN THE FURNITURE INDUSTRY, 1920–21

Investment group	Number of companies	1920	1921
Over $500,000	34	27.2	11.2
$300,000 to $500,000	44	29.0	7.6
$100,000 to $300,000	168	28.5	6.4
Under $100,000	53	31.4	6.1

At first glance, the employment data and the earnings data appear to be contradictory. With regard to employment, the figures indicate that the larger concerns recorded the greater fluctuations; with regard to earnings, the larger concerns appear the more stable. The antagonism of these two generalizations may be due to the inadequacy of the data on which they are based. This is a matter which the future may be able to correct. But the generalizations may not be a contradiction. They may be explainable in terms of differing business policy.

For example, the manufacture of pig iron is an enterprise which has come definitely under the domination of large-scale operation. In recent years there has been a marked reduction in pig iron price fluctuations. According to Dr. Blackett, this change was particularly apparent about 1907,[32] which was the first time that the new large companies faced a severe industrial depression. According to Dr. Berglund,[33] even wider fluctuations occurred prior to 1900, when the United States Steel Corporation was formed. This reduced fluctuation in prices finds no corresponding reduction in production. Never before was there a decline in output so marked as that of 1921, and the reduction in output

[31] United States Federal Trade Commission, *Report on the House Furnishings Industries*. Vol. 1, p. 67, Washington, 1923.

[32] O. W. Blackett, "Some Price Determining Factors in the Iron Industry," *Review of Economic Statistics*, Vol. 7, p. 203.

[33] Abraham Berglund, "The United States Steel Corporation and Price Stabilization," *Quarterly Journal of Economics*, Vol. 38, p. 1.

in the minor recession of 1924 to less than one-half that of the corresponding months in the previous year, is approximately equal to that of such earlier depressions as 1908 and 1894. The records indicate a trend toward production cycles rather than price cycles. In fact, the policy of price stabilization was openly avowed by the United States Steel Corporation in 1921–22. It is, therefore, by means of reducing production, which was reflected in the employment figures, that the larger corporations are able to record less reduction in earnings than do the small corporations, which follow a different policy.

From the point of view of the industry concerned, the policy of price maintenance probably tends to prevent speculation, and to that extent, tends to create some degree of actual stabilization. But from the point of view of those persons who advocate higher interest rates, or higher wage rates, or, in general, higher costs during the expansion, as a method of preventing overdevelopment, the undue expansion of other industries may even be stimulated by stable prices of such basic raw materials as iron and steel. Nor will the maintenance of high prices during depression prove a helpful factor in terminating depression. Furthermore, the transfer of incidence of the cycle from prices to production spells less regular employment for workers.

VII. THE GEOGRAPHICAL STRUCTURE OF INDUSTRY[34]

Migration among Areas.—Everyone has heard of the migration of the cotton textile industry southward, the boot and shoe industry westward, and the soft coal industry out of Pennsylvania. We are less familiar with the more general problem of the movement of manufacturing industry as a whole. We think of certain areas of the United States as manufacturing areas, certain others as agricultural, and certain others as mining centers. But in all three, instances of migration are evident. The history of Nevada is a story of mining rush and mining ebb; the recent record of Georgia shows an amazing turn away from cotton growing. But it is in manufacturing, not as tied to its original location by natural resources as are the other two, that one would expect the greatest mobility.

A direct comparison of manufacturing activity among the states loses much of its significance when one realizes that differences in area and density of population may determine the ranking rather than the degree of manufacturing. New York, with its 1,066,202 wage earners, is actually less dominated by manufacturing than Rhode Island, with but 120,346 manufacturing workers. In New York State, of the total number engaged in agriculture, manufacture, and mining in 1919, 83.1 per cent were in manufacturing, while 95.3 per cent were so engaged in

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[34] The bulk of the statistical material in this section was selected by William Harrison Carter, Jr., instructor of economics, Amherst College.

TABLE 28.—CHANGE IN PERCENTAGE OF WAGE EARNERS ENGAGED IN MANUFACTURE, AGRICULTURE, AND MINING, BY STATES

State	Per cent which total number engaged in manufacture is of total in agriculture, manufacture, and mining, 1919	Per cent change in average number of wage earners engaged in manufacture	
		1914–1925	1923–1925
Maine	61.5	92.0	88.6
New Hampshire	77.6	85.1	88.5
Vermont	46.3	86.2	89.5
Massachusetts	94.0	98.0	88.7
Rhode Island	95.3	106.9	89.4
Connecticut	90.2	107.7	92.1
New York	83.1	102.4	92.8
New Jersey	90.7	115.0	95.0
Pennsylvania	68.0	109.4	91.3
Ohio	68.1	134.2	96.9
Indiana	50.8	144.8	96.5
Illinois	63.6	124.4	96.5
Michigan	64.3	192.4	102.4
Wisconsin	51.8	129.1	99.9
Minnesota	32.2	110.9	97.0
Iowa	23.8	123.1	96.6
Missouri	37.6	131.5	99.6
North Dakota	4.8	109.7	91.8
South Dakota	7.1	155.5	100.1
Nebraska	20.8	112.9	87.5
Kansas	23.5	116.8	91.1
Delaware	65.4	95.4	89.6
Maryland	63.3	90.2	97.8
District of Columbia	94.7	111.7	99.7
Virginia	31.2	115.6	100.6
West Virginia	29.0	116.4	94.2
North Carolina	27.1	139.4	104.9
South Carolina	17.1	143.1	103.4
Georgia	18.9	142.5	102.7
Florida	42.8	123.1	101.9
Kentucky	16.0	126.4	99.9
Tennessee	21.6	154.8	101.3
Alabama	18.5	136.0	106.4
Mississippi	11.5	125.1	101.6
Arkansas	12.5	110.8	98.8
Louisiana	28.3	115.1	93.2
Oklahoma	9.8	166.4	103.8
Texas	13.9	147.7	104.6
Montana	17.3	110.6	92.7
Idaho	18.9	182.7	96.6
Wyoming	18.4	227.1	84.3
Colorado	27.6	120.6	102.9
New Mexico	9.7	130.4	84.8
Arizona	16.5	134.4	101.3
Utah	30.1	112.6	101.2
Nevada	21.1	73.9	79.4
Washington	58.7	160.1	95.0
Oregon	46.1	213.5	95.3
California	51.4	182.6	101.7

Rhode Island. The changes which have taken place in recent years do not necessarily represent the actual movement of a firm from one locality to another. In fact, it more often is the result of the closing down of some concern in one place, and the opening of a new concern elsewhere. Furthermore, there has been a marked tendency recently toward the establishment of branch plants to feed certain areas. Finally, new industries develop, which do not necessarily settle in the old areas. All these changes result in a net migration of industry.

The growth of the various sections of the country is evidenced by the data from the census of manufactures shown in Table 29. The outstanding facts in this material are the extraordinary advance of the Pacific states, the gain by the East North Central division, and the failure of the New England states, and, to some extent, the Middle Atlantic section, to keep pace with the rest of the country.

TABLE 29.—DEVELOPMENT OF THE SECTIONS OF THE COUNTRY, 1925, ACCORDING TO VARIOUS INDEXES, 1914 EQUALS 100[a]

Area	Number of establishments	Number of wage earners	Primary horse power	Value of products	Value added by manufacture
United States	104.8	120.9	160.7	261.2	274.3
New England	101.1	99.2	140.3	211.8	233.5
Middle Atlantic	99.3	107.2	150.7	238.1	262.0
East North Central	107.2	141.3	186.3	293.0	304.1
West North Central	102.8	122.3	150.2	235.7	244.6
South Atlantic	98.1	121.6	152.4	274.0	299.7
East South Central	106.1	143.0	139.6	263.8	252.2
West South Central	111.7	129.8	136.5	322.4	307.1
Mountain	110.6	127.7	165.0	242.7	222.4
Pacific	139.1	179.9	207.7	327.9	344.1

[a] The original Census data for 1914 were corrected to exclude establishments having a product of less than $5,000, except in the case of horse power, where data are not available to make the correction The figures for 1914 include "Coffee and spice, roasting and grinding" and "Automobile repairing," for which data were not collected in 1925.

TABLE 30.—DEVELOPMENT OF THE SECTIONS OF THE COUNTRY, 1925, ACCORDING TO VARIOUS INDEXES, 1923 EQUALS 100

Area	Number of establishments	Number of wage earners	Primary horse power	Value of products	Value added by manufacture
United States	95.8	95.6	108.2	104.1	103.6
New England	95.4	89.5	104.8	96.3	94.0
Middle Atlantic	89.5	92.5	105.0	98.7	101.5
East North Central	97.8	98.2	111.4	107.1	108.2
West North Central	98.5	96.7	109.2	111.0	104.7
South Atlantic	97.6	100.9	109.9	107.4	110.4
East South Central	108.1	102.6	110.6	107.0	107.7
West South Central	100.2	99.5	103.9	122.8	115.0
Mountain	97.4	96.9	106.1	109.8	103.5
Pacific	105.0	99.0	120.5	107.3	101.2

A similar comparison is presented in Table 30 comparing 1925 with 1923. It does not seem possible that such a short period could see any considerable change in the relative importance of the various sections of the country, but the different trends are clearly shown. This more recent material brings out a new development, the rapid growth of the South as a manufacturing area. The three southern divisions lead in the rate of increase both in number of wage earners employed and the total value added by manufacture.

The trends which are indicated by the tables for divisions are more clearly presented in Table 28 for the individual states.

A significant factor in this migration among localities is the comparatively recent development of branch plant operation. As a means of keeping transportation costs low, and of giving rapid service for dealers who require rush delivery, the branch plant represents an accepted form of expansion to-day. A study made by the United States Chamber of Commerce for the year 1927 gives in Table 31 the facts concerning the establishment of new branch plants during that year.

TABLE 31.—COMPARATIVE LOCATION OF HEADQUARTERS AND BRANCH PLANTS CONSTRUCTED IN 1927

Location of branch	Location of headquarters									
	New England	Middle Atlantic	East North Central	West North Central	South Atlantic	East South Central	West South Central	Mountain	Pacific	Total
New England	6	6	2							14
Middle Atlantic	2	23	3	1	3					32
East North Central	1	6	22	1		1		1	4	36
West North Central	1	3	3	14			2	1	1	25
South Atlantic	1	14	4	3	8	2				32
East South Central		1	3		1	2				7
West South Central			1	3	1	2	6			13
Mountain			1					5	2	8
Pacific	2	18	19	2	1				13	55
Total	13	71	58	24	14	7	8	7	20	222

More than one-half of these branches are located beyond the boundaries of the division in which the headquarters office is located. About three out of every five headquarters offices are located in the Middle Atlantic and East North Central divisions. The largest number of branches with headquarters outside the division are in the Pacific states, with the South Atlantic second.

The same study by the United States Chamber of Commerce gives information concerning the size of these new branches which are established. They are by no means small-scale establishments, as the following statement of number and distribution of new branch plants according to number of wage earners, 1927, indicates:

1 to 5 wage earners	17
6 to 10 wage earners	33
10 to 25 wage earners	53
26 to 50 wage earners	40
51 to 100 wage earners	34
Over 100 wage earners	41

The material concerning the establishment of new branch plants is in accord with the tendencies depicted in the more general data for geographical migration of industry. There is a trend leading to the more equal distribution of manufacturing activity throughout the country. The old areas have lost their supremacy, and the greatest gains are being made by those states in which manufacturing has not been relatively important.

Location as between City and Country.—Quite as important as the shift of industry geographically is the movement from city to country. The Department of Agriculture has made us familiar with the migration of farmers from country to city; we know less of the movement which has carried manufacturing into the country. Between 1919 and 1925, while the 25 largest cities in the country lost 326,800 wage earners, about 12 per cent of the average number employed, the rural area (all area not included in communities having a population of 10,000 inhabitants) gained 55,204 wage earners. Nor is this decrease limited to the larger cities. Cities between 100,000 and 250,000 population lost even more heavily, 14 per cent of their wage earners; communities between 25,000 and 100,000 lost 11 per cent, and those between 10,000 and 25,000 lost 8 per cent of their wage earners.

In the studies which have been presented in the quinquennial censuses concerning this problem, the communities have been classed at each census according to their size at the time. Consequently, the gradual increase in size of communities resulted in apparent increase in urban concentration and decrease in the rural areas. For this study, the communities have been grouped according to their size on January 1, 1920. It should be further noted that high land costs and the incidence of taxation have resulted in many plants locating themselves just outside the city boundary. The real importance of many cities can be properly ascertained only by combining with the establishments actually located in the city all the neighboring manufacturing establishments identified or closely associated with its industrial development. The difficulties in the way of such tabulation are many. The Census Bureau has adopted the practice of using metropolitan areas for certain of the larger cities, in the attempt to eliminate this difficulty somewhat. Table 32 presents the facts of the urban-rural movement for the various geo-

TABLE 32.—DISTRIBUTION OF WAGE EARNERS BY GEOGRAPHICAL DIVISIONS, ACCORDING TO SIZE OF COMMUNITIES, 1919–1925[a]

Size of community	Number of communities	1919		1925		Per cent change 1919 to 1925
		Number of wage earners	Per cent of total	Number of wage earners	Per cent of total	
UNITED STATES						
Total		9,050,829		8,380,674		−7.4
Over 250,000	25	2,763,494	30.5	2,436,694	29.1	−11.8
100,000–250,000	43	1,016,388	11.2	873,813	10.4	−14.1
25,000–100,000	215	1,637,786	18.1	1,461,653	17.4	−10.8
10,000–25,000	456	954,600	10.5	874,749	10.5	−7.8
Remainder		2,678,561	29.7	2,733,765	32.6	+2.1
NORTH EAST						
Total		1,348,190		1,122,216		−16.7
Over 250,000	1	88,529	6.6	77,334	6.9	−12.6
100,000–250,000	10	341,237	25.3	273,233	24.3	−20.0
25,000–100,000	35	367,440	27.3	302,436	26.9	−18.2
10,000–25,000	67	225,366	16.7	191,584	17.1	−15.1
Remainder		325,618	24.2	277,629	24.7	−14.8
MIDDLE ATLANTIC						
Total		2,862,484		2,491,039		−13.0
Over 250,000	7	1,262,289	44.1	1,067,004	42.8	−15.5
100,000–250,000	8	197,198	6.9	163,983	6.6	−16.8
25,000–100,000	48	427,909	15.0	369,911	14.9	−13.6
10,000–25,000	110	270,261	9.4	249,699	10.0	−7.6
Remainder		704,927	24.6	640,442	25.7	−9.2
EAST NORTH CENTRAL						
Total		2,388,970		2,342,799		−1.9
Over 250,000	6	931,161	39.0	858,587	36.6	−7.8
100,000–250,000	6	207,716	8.7	188,380	8.0	−9.3
25,000–100,000	61	517,142	21.6	486,869	20.8	−5.9
10,000–25,000	101	244,827	10.2	224,468	9.6	−8.4
Remainder		488,124	20.4	584,495	24.9	+19.8
WEST NORTH CENTRAL						
Total		494,255		452,820		−8.4
Over 250,000	3	167,692	33.9	162,328	35.8	−3.2
100,000–250,000	4	73,719	14.9	61,271	13.5	−17.4
25,000–100,000	14	63,636	12.9	56,597	12.5	−11.1
10,000–25,000	48	54,286	11.0	51,892	11.5	−4.4
Remainder		134,922	27.3	120,732	26.7	−10.4
SOUTH ATLANTIC						
Total		808,864		838,834		+3.7
Over 250,000	2	107,950	13.4	95,550	11.4	−11.5
100,000–250,000	4	63,878	7.9	55,323	6.6	−13.5
25,000,000–100,000	21	136,376	16.8	125,100	15.0	−8.3
10,000–25,000	35	64,485	8.0	68,259	8.2	+5.9
Remainder		436,175	54.0	494,602	59.0	+13.4
EAST SOUTH CENTRAL						
Total		324,762		355,578		+9.5
100,000–250,000	4	69,636	21.5	74,263	20.8	+6.6
25,000–100,000	7	41,251	12.7	43,801	12.3	+6.2
10,000–25,000	22	33,154	10.2	34,879	9.8	+5.2
Remainder		180,721	55.6	202,635	57.1	+12.1
WEST SOUTH CENTRAL						
Total		282,312		264,990		−6.1
Over 250,000	1	26,535	9.4	22,118	8.3	−16.6
100,000–250,000	4	28,695	10.2	30,827	11.6	−7.4
25,000–100,000	12	25,570	9.0	24,861	9.4	−2.5
10,000–25,000	36	22,939	8.2	21,087	7.9	−8.0
Remainder		178,573	63.2	166,097	62.6	−7.0
MOUNTAIN						
Total		107,759		100,374		−6.9
Over 250,000	1	16,514	15.3	15,077	15.0	−8.7
100,000–250,000	1	6,309	5.8	4,898	5.0	−22.2
25,000–100,000	5	7,393	6.8	5,460	5.5	−25.7
10,000–25,000	16	13,039	12.1	9,294	9.3	−29.0
Remainder		64,504	60.0	65,645	65.2	+2.0
PACIFIC						
Total		432,963		415,024		+10.4
Over 250,000	4	162,824	37.6	138,696	33.5	+18.0
100,000–250,000	2	28,000	6.5	21,635	5.2	−8.5
25,000–100,000	12	51,069	11.8	46,618	11.3	+18.5
10,000–25,000	21	26,073	6.0	23,587	5.7	−22.5
Remainder		164,997	38.1	184,488	44.4	+13.8

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[a] The Bureau of the Census provided data for many cities in 1919 where material could not be published by them. In some few cases for 1925, it has been necessary to make estimates, but they were always for small cities and cannot seriously affect the figures here given. The data are corrected for establishments with products under $5,000 but not for the change in the "coffee roasting" and "automobile repairing" industries, both of which are included in 1919 and not in 1925.

graphical divisions in the country. As might be expected, it has not been uniform. The urban loss is, of course, greatest in amount in those sections where the cities are located, the Middle Atlantic and East North Central districts. The rural gain is most remarkable in the East North Central division. The South Atlantic and the Pacific divisions also show increased manufacturing activity in the rural areas.

Further light on this problem is shed by the data collected by the Chamber of Commerce of the United States concerning plants which moved from one locality to another during 1927. It is possible to subdivide 228 instances according to the population of the community which they left, and the population of the community to which they went. These data are summarized in Table 33

TABLE 33—DISTRIBUTION OF PLANTS REMOVED IN 1927, ACCORDING TO THE POPULATION OF THE COMMUNITY LEFT AND THE COMMUNITY ENTERED

Population of community entered	Population of community left								
	Under 10,000	10,000 to 25,000	25,000 to 50,000	50,000 to 100,000	100,000 to 200,000	200,000 to 300,000	300,000 to 500,000	Over 500,000	Total
Under 10,000	12	6	3	2	1		2	18	44
10,000 to 25,000	12	4	1	2	5	2	2	12	40
25,000 to 50,000	5	2	4	1		2	2	19	35
50,000 to 100,000	6	1	4	2	1		5	10	29
100,000 to 200,000	4	3	1	6	3			21	38
200,000 to 300,000	4				2			4	10
300,000 to 500,000	2			1		2		4	9
Over 500,000	1	4	1	4	4	1	2	6	23
Total.	46	20	14	18	16	7	13	94	228

There are 30 cases where the plant remained in the same population group; but there are 72 in which it went to a larger community and 126 in which it sought a smaller community. The only group to report a serious net loss is that of cities over 500,000, while the gains were made chiefly in the cities under 200,000. The results correspond with those already indicated by the census data.

The advantages which the small town can offer are, usually, low taxes, low real estate values, less freight congestion, and above all, lower labor cost. On the other hand, the obstacles are the forces of inertia, the material concentration, and the requisites essential for large-scale production. It appears that at present the first list of forces is stronger.

There are certain conspicuous differences between manufacturing industry in the large cities and in the smaller groups. First, there is a difference in the matter of size. In 1919, the only year for which proper figures are available, it was clear that the cities of over 250,000 population had more than their due share of establishments employing 6 to 50 wage earners, that the cities having a population between 100,000 and 250,000 had more than their share of the larger establishments, and the rest of the country was in advance of its relative position in the very small establishments. The details of this situation appear in Table 34.

TABLE 34.—SIZE OF ESTABLISHMENTS, BY SIZE OF COMMUNITIES, 1919

Population group	Percentage distribution of establishments employing (wage earners)—									
	Total	None	1 to 5	6 to 20	21 to 50	51 to 100	101 to 250	251 to 500	501 to 1,000	Over 1,000
Over 250,000	31.7	32.8	26.9	39.6	40.2	34.5	29.2	28.0	29.2	25.7
100,000 to 250,000	7.0	6.5	5.8	7.9	8.9	9.8	9.2	9.1	12.0	14.8
Under 100,000	61.2	60.6	67.3	52.3	50.8	55.6	61.5	62.7	58.7	59.4

A similar calculation, based on the value of products, shows that the smallest establishments are in the section of the country not including communities of over 100,000 population, the cities over 250,000 are strongest in the establishments producing from $100,000 to $500,000 per year, and the middle group of cities is strongest in the largest establishments.

A further demonstration of the more recent tendencies in this connection can be obtained from the tabulation presented in Table 35 with certain additional material. The average number of wage earners per establishment in the various population groups is given in Table 35.

TABLE 35.—AVERAGE NUMBER OF WAGE EARNERS PER ESTABLISHMENT, BY SIZE OF COMMUNITY, 1919 AND 1925

Population of community	1919[a]	1925
Over 250,000	35.7	35.1
100,000 to 250,000	60.6	56.7
25,000 to 100,000	63.1	64.0
10,000 to 25,000	52.9	57.9
Remainder	31.0	42.3

[a] Corrected for establishments with product under $5,000, but not for "automobile repairing" or "coffee roasting," both of which were included in 1919 and not in 1925.

Not only are these data important as indicating the difference between urban and rural, but they also indicate the trend. There is evidence that the plants in the large cities are actually decreasing in size, while the establishments in the rural areas have grown remarkably in such a short period. This is a further sign of the tendency toward equalization of manufacturing throughout the country.

A further distinction between urban and rural manufacturing lies in the nature of the industries concerned. Of the 324 industries reported in the Census of Manufactures in 1925, 71 appear as one of the leading five industries, in terms of wage earners, in at least one of the 68 cities reporting over 100,000 population in 1921. Industries appearing in at least 5 cities and ranked according to the number of times they appear as one of the five leading industries in 68 cities, 1925, are shown in the following statement:

Foundry and machine shop	40
Steam railroad shop	39
Printing and publishing	37
Bread and baking	18
Electrical machinery	15
Motor vehicles	15
Men's clothing	14
Knit goods	10
Steel works and rolling mills	9
Boots and shoes	7
Cigars and cigarettes	7
Motor vehicle parts	7
Slaughtering and meat packing	7
Confectionery and ice cream	5
Furniture	5
Machine tools	5
Planing mills	5

It is evident that the three industries which appear so often are important in every city, and that, in the absence of any other outstanding industry, they appear in the ranking. Among the general industrial groups of the census, the two which lead in urban activity are machinery and textiles.

Local Concentration of Industry.—Not only is manufacturing *in toto* becoming less concentrated in a particular section of the country, but industries are also tending to be less concentrated in certain favored spots. At once, one thinks of Fall River, Akron, Gloversville, Troy, Paterson, Detroit, and a host of other cities whose history is closely related to some one industry. While there are but few cases where the early center has actually lost the industry, in most cases its dominance has disappeared, owing to its failure to keep pace with the growth of the industry in other parts of the country. Although the slaughtering and meat packing industry in Chicago has more than doubled its value of products since 1899, the city fell from 35.6 per cent of the national total to 18.8 per cent during the period. Likewise Philadelphia more than doubled the number employed in making carpets and rugs, yet fell from 45.6 per cent of the nation's total to 27.8 per cent. In a mere handful of instances has any considerable concentration come about in recent years. In the jewelry industry, New York City has risen from 19.7 per cent in 1899 to 34.5 per cent in 1925 at the expense of Providence and Attleboro. Similarly, in the corset industry, New York City has advanced from 11.5 per cent to 27.5 at the expense of Bridgeport and New Haven, and in the hairwork industry, it advanced from 41 per cent to 76 per cent in 1925. These three instances stand alone on the records available. The trend is decidedly the other way. Furthermore, they represent not a gathering of industry in one center from many scattered spots, but a transfer from one spot of concentration to another. From the point of view of Attleboro and Bridgeport, the instances represent a break in the concentration of industry.

A further demonstration of this breaking down of local concentration of industry was obtained from examining all cases for which continuous records were available since 1899 for communities which at some time produced at least 3 per cent of the national product in some industry. In this way, it was possible to obtain records for 105 instances of local concentration. The percentage which each community was of the national total was then computed for each census date, to determine whether it was gaining or losing in relative position. The following statement shows the distribution of 105 instances of local concentration according to the census date at which the community reached its highest percentage of the national total.

1899	32	1919	14
1904	21	1923	9
1909	15	1925	10
1914	4		

It is quite conclusive that one-half the cases examined reached their highest point by 1904, and that but 10 of the 105 were at their highest point when the record ended.

Thus, one further evidence of the gradual evening out of manufacture is offered. First, there was the development of backward areas and the decline of the highly developed areas; second, the development of rural sections and the decline of the city; and third, the breakdown of local concentration in the historical centers of specific industries. And it is probable that all these mean more efficient production. Certainly, they will cause considerable saving in freight hauling, less delay in shipping. Furthermore, it tends to destroy the dependence of areas upon single types of activity for livelihood. Diversification of industry means less violent depressions and less excited prosperities, since the various industries do not move in exact accord, and their average will tend to be more stable than single industries. The advantages of local concentration have long been sung, but the day of diversification has come. It should be a happier one for many communities.

Location in Terms of Freight Rates.—We have discussed the movement of industry about areas as though the map was the real criterion of distance in the mind of the business man. He is much more concerned about distance in terms of two other dimensions, time of communication and freight rates. For the first, the introduction of the long-distance telephone and airplane mail has lessened its importance. But the cost of hauling freight is still extremely significant. A reduction in freight rates between Chicago and New York is just as significant as if all the industry of the Chicago district were moved eastward by that much.

As a matter of fact, the operation of the Panama Canal and the realignment of rates since the war have resulted in moving Chicago 336 cents away from the Pacific coast per ton of staple goods, while moving New York 224 cents nearer.[35] This situation offers a serious handicap to industry in the mid-west. Its market is reduced, while that of the Atlantic Coast States has been increased. The answer has just been made by the mid-west in the form of a new route for freight shipment. It appears in a freight tariff issued by the Illinois Central Railroad (I.C.C. No. A-10314). This offers to carry freight from points in Indiana to New Orleans, and to the Pacific Coast via the Panama Canal, over the Illinois Central Railroad and the Redwood Line (Inc.). The rates are so low that at least one large producer of steel is now shipping to the Pacific Coast by this route rather than by its own vessels on the Atlantic Coast. The opening of the new canal from Pittsburgh to the sea, via the Ohio and Mississippi Rivers, should be a further influence in giving the mid-west a more strategic position.

VIII. SUMMARY

When industries are measured according to the average number of wage earners per establishment, wide differences appear. There is no noticeable trend toward production on a larger scale. The tendency is rather for the extremes to move toward the middle, and points of concentration are appearing about 20 workers per establishment and 100 workers per establishment.

However, using horse power per establishment as the basis for measurement, the increase in the scale of production is evident. There has been a general and marked increase in horse power, and the development has by no means reached its culmination.

The implications of these two tendencies are significant in many respects. Plants can take on additional wage earners without the assistance of financial institutions, but large increases in machinery necessitate corresponding initial outlays. In addition to its interest for the investment banker, this increase in the capital structure has significance for the business cycle analyst. As long as the chief expense is labor cost, the manufacturer, by means of discharging employees, can reduce costs as his receipts are reduced. But with a large investment in machinery, his interest charges will continue whether he operates or not. From the point of view of the worker, it means that more and more of the actual labor is done by the machine, and we are coming more and more to merit the designation of the "machine age."

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[35] E. S Gregg and A. L. Cricher, *Great Lakes-to-Ocean Waterways*. Department of Commerce, Washington, 1927

It is evident that there are many combinations among industrial units. According to income tax returns, one-half of the largest enterprises in the country are engaged in manufacturing. However, the numbers in this field are not increasing so rapidly as in trade, banking, and other types of economic endeavor.

The records of mergers in recent years indicate that it has been a general movement, rather than one confined to any particular industries. It has been greatest among public utilities, reaching its height there in 1926. In manufacturing industry, the tendency to merge appears to follow the business cycle, but the general trend has been upward since 1922

The present mergers are unlike those of the great combination period at the end of the nineteenth century In the earlier instances, the incentives were usually either the formation of a monopoly or profits of some promoter. The present mergers often appear to be quickly followed by new financing, thus implying that the desire for additional capital is an important motive. A further incentive, in certain industries, has come from modern marketing methods, in which the concern which is large enough to undertake national advertising has a definite advantage over its smaller rivals.

It has long been claimed that large-scale operation offered many potential economies. It is evident that the most efficient size at which an industrial plant may operate has increased greatly during recent years. However, as regards combinations among such plants, the facts are entirely inadequate. The few available do indicate that, as often as not, these potential economies are more than offset by real losses in efficiency.

Over against this fact is the probability that the large concerns are taking an increasing part of the nation's business. This is also reflected in the record of the stock market, in which three of the four industries studied recorded the greatest advances made by the securities of the larger companies. Again, we conclude that this larger share in the nation's business is not owing to ability to produce at a lower cost, but to greater success in the field of marketing. An interesting side light on this development is the present status of the Sherman and Clayton Acts, which tend to encourage combinations, since the merged companies can adopt a uniform marketing policy which would be illegal if undertaken as independents.

In the case of random or casual fluctuations, small enterprises record wider variations than large concerns. This appears to be true both of unemployment and of earnings.

In the case of cyclical fluctuations, the data indicate that large corporations are subject to wider fluctuations in production and employment than the smaller concerns, but that their earnings are more stable.

This seems to be the result of a more or less conscious policy to shut down the plant and accept the losses resulting from idleness rather than to offer their products at greatly reduced prices, thus accepting the loss on inventory, but maintaining operation. The general tendency is therefore toward production cycles rather than price cycles.

The movement of industry among the areas of the country has tended definitely toward a more equal distribution of manufacturing. The rapid industrial growth of the South and the decline of New England and the Middle Atlantic States illustrate this tendency.

Quite as important is the shift from city to country. The records indicate a definite decline in manufacturing activity in the larger cities, and an actual gain in the rural areas, particularly in the East North Central and South Atlantic divisions. There is a marked increase in size in these rural enterprises, which have heretofore always been much below the general average.

The third step in this tendency toward the more equal geographical distribution of industry, is the breaking down of local concentration in the historical centers of specific industries.

CHAPTER III

CONSTRUCTION

By John M. Gries

I. CONSTRUCTION AND GENERAL ECONOMIC CONDITIONS, 1919–1928

The record-breaking volume of construction has been of profound importance to the American people. The business sections of cities have been transformed by the increasing erection of great buildings. Hundreds of thousands of miles of roads and streets have been improved and co-ordinated to meet the needs of 25 million automobiles. Surburban areas have spread out faster than ever before, built up with modern and more attractive dwellings, while at the same time apartment houses have become a more important factor in housing. The public utilities, furnishing the "roots" which bring to buildings light and power, running water, and communication, have been expanded more rapidly than ever before, and our industries have acquired vastly improved plants with which to work. And this program of construction, recently amounting to more than $7,000,000,000[1] annually, has been carried on, during the

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[1] *Statistics Relating to Value and Volume of Construction.*—The statement that construction has amounted, in round figures, to over $7,000,000,000 annually is derived by assuming that the per-capita construction in states for which the F. W. Dodge Corporation does not report contracts awarded is not greatly different from that in the remainder of the country. No attempt is made in this paper to estimate the value of small buildings and work of certain types not reported by the F W. Dodge Corporation, which might raise the total by a billion to a billion and a half or more dollars, nor to deduct from such an estimate various items included in the total cost of building projects which might not properly fall under common definitions of construction.

The F. W. Dodge Corporation figures on contracts awarded are shown in accompanying tables as the most comprehensive available The tables also show building permit statistics as classified by the Department of Labor and other agencies; reports on contracts awarded for public works, public utilities, and large buildings compiled by the *Engineering News-Record;* census reports on the financial statistics of cities; reports by the Bureau of Public Roads; and census, railway, and other data relating to the production and shipments of building materials.

The tables are presented, in the absence of any more satisfactory data, simply to give readers a general idea of the relative values of the different classes of construction, and of the fluctuations from year to year by classes of construction and geographic regions. There is no general index of construction employment. The data as to contracts awarded and building permits are similar to data on new orders in some other industries.

TABLE 1.—CONSTRUCTION CONTRACTS AWARDED, BY CLASSES

NOTE.—The value of military and naval buildings for 36 states in 1927 was $8,855,200 and the floor space amounted to 1,742,700 square feet, in 1928 the value was $14,527,500 and floor space was 3,578,700 square feet.

(Values in millions and tenths of millions of dollars; floor space in thousands of square feet)

Year	Total	Residential	Commercial	Industrial	Public works and utilities	Educational	Hospitals and institutions	Public buildings	Religious and memorial	Social and recreational
27 STATES										
Value of construction:										
1919	2,579.9	849.2	405.7	512.9	502.0	119.5	39.2	13.4	37.5	83.6
1920	2,533.2	566.1	419.7	589.0	566.3	172.3	47.5	26.6	41.4	91.1
1921	2,360.2	877.9	338.0	173.3	459.4	243.7	70.1	22.3	60.4	108.8
1922	3,352.7	1,347.2	496.3	325.0	562.2	303.3	86.6	32.4	86.1	110.0
1923	3,494.1	1,582.8	446.1	378.8	557.4	272.5	62.0	19.2	72.0	100.3
1924	3,879.5	1,842.5	522.2	285.1	577.3	317.1	98.3	28.6	96.3	109.8
1925	5,043.0	2,359.9	717.3	413.3	704.1	369.5	97.6	35.3	124.7	216.2
1926	5,421.7	2,338.8	784.1	592.3	861.3	321.1	120.8	44.3	127.9	223.5
1927	5,473.1	2,326.9	834.4	376.8	1,025.4	323.8	149.0	56.8	132.3	239.8
1928	5,843.9	2,551.2	785.3	506.1	1,133.3	347.2	153.7	50.7	109.0	194.5
Floor space of buildings:										
1919	560,219	241,880	110,884	153,268		22,979	6,821	2,066	5,334	15,175
1920	401,794	137,524	82,434	127,830	...	26,278	6,277	2,732	5,063	12,360
1921	387,229	204,575	65,235	35,771	...	40,583	10,683	3,056	9,201	17,466
1922	573,856	311,407	95,233	65,550	...	54,592	11,779	3,382	12,857	18,216
1923	591,976	354,257	92,788	62,205	...	44,332	9,997	3,123	9,284	15,435
1924	600,916	371,068	95,861	40,967	...	46,875	12,707	4,451	11,960	16,484
1925	762,146	470,207	124,064	58,719	...	51,204	12,020	4,703	13,814	26,476
1926	741,270	450,249	121,039	67,764	...	44,478	13,131	4,631	13,019	26,166
1927	723,655	434,856	118,940	58,052	...	45,197	16,967	5,983	13,187	28,974
1928	834,689	507,980	134,206	76,812	...	52,986	18,183	5,772	12,304	23,211
36 STATES										
Value of construction:										
1923	3,981.3	1,734.5	512.9	443.2	665.5	320.6	78.1	23.3	89.1	110.6
1924	4,485.8	2,050.1	596.3	355.3	723.9	367.4	112.5	35.9	119.1	123.0
1925	5,822.2	2,672.0	835.7	462.7	885.7	413.2	108.5	46.7	148.0	243.6
1926	6,152.0	2,579.3	880.1	677.1	1,068.2	367.1	130.6	54.8	144.5	241.6
1927	6,084.0	2,489.6	897.2	475.6	1,213.3	368.8	158.8	66.1	150.1	255.7
1928	6,404.8	2,715.1	847.6	602.6	1,288.6	386.5	162.0	57.3	122.4	208.2
Floor space of buildings:										
1923	678,565	392,747	109,508	73,421	...	55,688	12,307	3,806	12,710	17,721
1924	699,320	422,285	113,040	50,033	...	58,241	15,155	5,492	15,514	19,201
1925	887,550	540,509	151,062	67,478	...	58,700	13,595	6,703	17,786	30,584
1926	838,430	498,927	142,357	78,790	...	52,207	14,451	6,127	15,518	28,961
1927	803,546	474,279	133,142	68,904	...	53,062	18,292	7,429	15,952	31,555
1928	920,903	548,325	150,392	91,538	...	60,625	19,528	6,887	14,473	25,556

Source: The F. W. Dodge Corporation.

TABLE 2—INDEX NUMBERS OF BUILDING MATERIAL PRICES AND CONSTRUCTION COST

Year	(1) All commodity index	(1) Wholesale price indexes of— All bldg materials	Lumber	Brick	Cement	Steel	Paint materials	Other bldg materials	(2) Construction costs	(3) Factory bldg costs	(4) Frame house materials, retail prices	(4) Brick house materials, retail prices
1913	69.8	56.7	54.0	38.9	59.6	77.1	50.8	63.1	48.1		51.4	51.3
1914	68.1	52.7	49.9	38.8	55.0	60.0	50.7	59.7	42.6	50.8		
1915	69.5	53.5	48.7	39.1	51.0	65.3	54.8	65.1	44.5			
1916	85.5	67.6	55.1	42.4	65.4	128.9	77.1	87.8	70.9			
1917	117.5	88.2	72.2	50.2	80.3	190.8	95.3	114.0	87.1			
1918	131.3	98.6	83.5	66.7	94.6	153.2	121.9	121.0	91.0			
1919	138.6	115.6	113.0	91.9	102.3	128.7	140.3	116.8	95.4			
1920	154.4	150.1	165.2	118.4	117.2	144.4	148.1	135.0	120.8			
1921	97.6	97.4	88.9	105.7	110.8	104.4	83.9	111.1	97.0	90.9		
1922	96.7	97.3	99.1	99.4	103.5	88.5	93.8	95.3	83.9	86.3	93.3	95.3
1923	100.6	108.7	111.8	103.6	107.9	123.7	101.3	105.5	102.9	102.6	106.2	106.9
1924	98.1	102.3	99.3	103.4	105.7	114.2	99.7	104.0	103.6	100.5	103.4	104.4
1925	103.5	101.7	100.6	100.1	102.6	102.2	109.3	100.4	99.4	99.0	100.5	100.9
1926	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1927	95.4	93.3	92.5	93.2	96.7	94.7	91.0	94.1	99.1	97.5	96.1	96.5
1928	97.7	93.7	90.1	92.7	95.9	95.2	86.6	101.3	99.4	97.0	91.4	93.9

Sources: (1) Department of Labor; (2) Lumber, steel, cement and common labor, *Engineering News-Record*, (3) Standard factory building, Aberthaw Co, (4) Retail prices of building materials in 45 cities, Department of Commerce

TABLE 3.—RELATIVE VALUE OF THE SEVERAL CLASSES OF CONSTRUCTION CONTRACTS

Class	Per cent of total value—27 states										Per cent of total value—36 states			
	1919	1920	1921	1922	1923	1924	1925	1926	1927	1928	1925	1926	1927	1928
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Residential	32.9	22.3	37.2	40.2	45.3	47.5	46.8	43.5	42.5	43.7	45.9	41.9	40.9	42.5
Commercial	15.7	16.6	14.3	14.8	12.8	13.5	14.2	14.4	15.3	13.4	14.4	14.3	14.8	13.2
Industrial	19.9	23.3	7.3	9.7	10.8	7.3	8.2	10.9	7.0	8.7	7.9	11.0	7.8	9.4
Public works and utilities	19.5	22.4	19.5	16.8	16.0	14.9	14.0	15.8	18.7	19.4	15.2	17.4	19.9	20.1
Educational	4.6	6.8	10.3	9.0	7.8	8.2	7.3	5.9	5.9	5.9	7.1	6.0	6.1	6.0
Hospitals and institutions	1.5	1.9	3.0	2.6	1.8	2.5	1.9	2.2	2.7	2.6	1.9	2.1	2.6	2.5
Public buildings	0.5	1.1	0.9	1.0	0.5	0.7	0.7	0.8	1.0	0.9	0.8	0.9	1.1	0.9
Religious and memorial	1.5	1.6	2.6	2.6	2.1	2.5	2.5	2.3	2.4	1.9	2.5	2.4	2.5	1.9
Social and recreational	3.2	3.6	4.6	3.3	2.9	2.8	4.3	4.1	4.4	3.3	4.2	3.9	4.2	3.3
Military and naval buildings	0.7	0.5	0.3	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.1	0.1	0.1	0.2

Sources: Division of Statistical Research, Bureau of Foreign and Domestic Commerce, based on data furnished by the F W. Dodge Corporation

TABLE 4.—TOTAL BUILDING CONTRACTS AWARDED, BY FEDERAL RESERVE DISTRICTS

(In thousands of dollars)

District	1919	1920	1921	1922	1923	1924	1925	1926	1927
Total[a]	2,370,529	2,320,577	2,157,277	3,003,155	3,972,084	4,458,942	6,007,305	6,384,406	6,303,056
First (Boston)	222,057	285,529	193,747	317,639	311,344	332,018	453,409	417,546	389,139
Second (New York)	560,299	595,442	654,062	919,380	1,088,980	1,356,300	1,625,101	1,799,099	1,708,074
Third (Philadelphia)	238,080	176,946	179,037	254,171	228,115	327,678	360,710	418,719	487,217
Fourth (Cleveland)	413,553	401,920	353,334	473,109	503,027	503,923	709,827	651,376	673,354
Fifth (Richmond)	185,351	154,662	207,620	267,745	295,193	311,020	399,291	439,571	409,011
Sixth (Atlanta)	....	..	....	....	304,592	388,392	570,526	521,366	380,771
Seventh (Chicago)	659,514	596,100	471,264	677,462	691,281	730,216	1,044,137	1,162,560	1,288,332
Eighth (St. Louis)	....	..	..	...	277,187	293,426	372,048	392,029	401,799
Ninth (Minneapolis)	91,676	109,978	98,212	93,651	144,432	102,387	113,011	123,678	110,122
Tenth (Kansas City)	....	....	...	..	127,931	113,581	150,737	197,378	212,369
Eleventh (Dallas)						(b)	208,508	261,083	242,869

[a] For the districts for which figures are shown

[b] Contracts awarded in the Eleventh District during the eight months, May to December, 1924, valued at $142,163,000, are not included in the total

Source: F. W Dodge Corporation and Federal Reserve Board.

last seven years, in such a way as to help stabilize and act as a tonic on general business conditions.

The shortage of buildings resulting from the dislocation of construction programs during the World War led to a program of construction in 1919 and 1920 which was speeded up and pressed forward in the face of cost inflation. This contributed to the unhealthy business boom and the precipitate recession which followed.

The rapid falling off of new building during the latter part of 1920 demonstrated the uncertainty which may hang over the industry. Owing to the large number of structures already in use, a decline even of 20 or 30 per cent in one year's new building may not have much effect on the total supply of structures. When the business outlook is uncertain, or when their income is reduced, many owners may postpone building for a year or more, without great hardship to themselves. But a much smaller decrease than 20 per cent may seriously disturb employment conditions among upward of one and a half million workers in the building trades, and perhaps as many more workers in other industries allied with construction.

The prosperity of hundreds of communities depends upon the amount of building materials called for, including lumber and millwork, structural steel, cement, brick, sand and gravel, tile and other clay products, lime, nails, sheet metal, plumbing and heating equipment and fixtures, electrical supplies, paints and varnish, glass, building paper, and roofing materials. These and other building materials, in crude or finished form, represent more than one-eighth of all railway freight tonnage, and it is obvious that even a 5 or 10 per cent reduction in shipments will cut rather seriously into the earnings of the railways and of their employees.

With such facts in mind, the President's Conference on Unemployment, in October, 1921, concluded that "a return of confidence in values in construction will assure more employment than in any other field of industry. Considering all branches of the industry, more than 2,000,000 people could be employed if construction would be resumed." The active building which has continued since has been an energizing force in business, especially in the recovery in 1922, and in 1924 and 1927, when recessions took place in other lines.

Only once since 1920 has there appeared serious danger of an inflationary boom. In the spring of 1923, new construction was being projected so rapidly that wholesale building material prices rose 10 per cent in four months. The Secretary of Commerce, in March, 1923, in reply to a request from the President, suggested that all Federal Government building not urgently required by public necessity be deferred for the time being. In April the report of the Committee on Business Cycles and Unemployment advised against pressing on with building activity at times when it would involve rapid bidding up of prices for materials and labor, and the problem was widely discussed in trade papers. The building program was safely accommodated to the capacity of the industry, and building costs[2] have never since been so high.

The comparative stability in total volume of construction has not meant an equal stability for each type of construction, or for individual cities or regions. The number of homes built and the total floor space of all buildings for which contracts were awarded was higher in 1925 than in 1926 or 1927, and the falling off in such work was reflected in smaller shipments of various building materials and some lessening in the demand for building-trades workers. The increase in public works and utilities construction, however, led to greater production of some other materials, such as cement, sand, and gravel, and involved a shift in types of labor employed. Even in the period since 1925, new building undertaken in some of the largest cities has fallen off from 15 to 20 per cent, or even more, from one year to the next. Similar fluctuations have been noted between areas embraced in different Federal Reserve districts.

Trends Affecting Stability.—From the national point of view, it is important to throw light on whether the relatively stable national totals have been owing primarily to chance or coincidence, and how far underlying forces have been developed which have helped to keep the national totals from fluctuating materially.

A complete analysis would involve discussing the major elements of business conditions for several decades, but only certain principal changes are mentioned here. It is assumed that the amount of construction carried on at a given time is not entirely dependent upon what is happening in other lines, and that it is not the single dominant factor in the business situation. It is one very important factor, subject in some measure to other influences, and at the same time it reacts intimately upon other lines.

Changes Relating to the Demand for Construction.[3]—The nature of the basic factors in the demand for construction, and the immediate stimuli which occasion various classes of projects, must both be considered.

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[2] The indexes of building material prices may be considered fairly satisfactory so far as they go, although they are not weighted yearly for fluctuations in the character of construction. Most of the building cost indexes are "synthetic," rather than based on actual records, and assume a fixed quantity of labor and materials. They do not take into account such factors as variation between published and actual wage rates, the efficiency of labor, improved design, labor-saving equipment, savings to the owner due to decreased time of construction, and competitive conditions which may affect the profit which contractors are willing to accept.

[3] See Seasonal Stabilization, Chap. V, Marketing, p. 343; Chap. VI, Labor, p. 482; Chap. VII, Management, p. 503; Chap. IX, Price Movements, p. 613.

Assuming that living standards do not decline, the 1,600,000 or 1,700,000 additional inhabitants each year call for an annual addition of about 400,000 homes, with other types of structures roughly in proportion. As has been shown in the first chapter, the annual increase in population has become much more nearly stabilized under the operation of the restrictive immigration acts.

The net loss of farm population to cities and towns has resulted in an unusual demand for urban dwellings.

The razing or abandonment of buildings on account of fire, physical deterioration which makes them unfit for use, or for other cause, probably has not changed much as a factor.

The growth in per capita income during the postwar period has been reflected in a demand for improved dwellings and structures of various types, including places of work and recreation. Coupled with advancement in the design and equipment of buildings, obsolescence of existing structures has had an important effect. Larger incomes have meant an increase in number of automobiles, a greater demand for highway construction, and the building of garages and service stations. The motion picture industry has grown with the motion picture theater made more accessible by automobiles and improved roads. Recognition of better standards of working conditions in offices and factories has brought improved construction. Greatly enlarged attendance at schools and colleges has resulted in vast additions to educational buildings.

Increased construction programs are thus bound up with increased productivity in other lines of industry, and with trends in family life and expenditures which are made possible by larger incomes.

Increased savings have permitted enlarged construction programs to meet enlarged demand, and at the same time have stimulated construction projects as profitable investments.

Various outstanding construction projects of a public or semipublic character have occasioned much construction of other types. By cutting through new or wider streets, or by electrification of railway terminals, desirable sites made available in the central business districts of cities have been covered by large modern buildings. The many new vehicular bridges and tunnels inevitably result in changed use of land in various districts, and have led to much new building.

Supply of Investment Funds.—During the period between the Civil War and the World War the savings funds of the nation were not always adequate for its capital requirements, and the demand for funds with which to carry on construction tended to press upon the supply. When unusually large amounts were borrowed abroad, and there was an enlarged demand upon the physical capacity of the country to produce materials, furnish transportation, and supply labor, construction costs usually went up.

During the past ten years the relation of domestic investment funds to construction has been reversed because the United States has become a lending nation, more than able, from the point of view of total savings, to finance its own needs of domestic capital. The pressure comes from funds seeking employment, rather than from construction projects deferred for want of capital.

One corollary of this is that large construction programs are less apt physically to overtax the nation's productive capacity. In 1923 there was a logical coincidence between the small net amount of lending abroad, the expansion in imports and small margin of exports, and, on the other hand, the large expansion of new construction with a sharp upturn of building material prices and building-trades wages, indicating a scarcity of building-trades labor. Since 1923 the productive capacity of the building material industries, the adequacy of the railways in transporting materials, and of the labor supply to carry on construction have proved sufficient.

Interest Rates.—The lower trend of interest rates has been favorable to construction. Considering the present worth of interest payments made over a period of years, a decrease of 1 or 2 per cent in the rate at which funds are borrowed reduces the first cost of the building by a much larger percentage. Probably of more importance, higher long-term interest rates usually indicate competition for the use of funds, and some classes of builders have to defer building because they cannot borrow through ordinary channels. In the year 1921, for example, although commercial credits were being curtailed and interest rates were falling, local savings banks and building and loan associations commonly were short of funds to lend on mortgages.

Organization of Building Finance.—Steady progress has been made toward systematizing the financing of the nation's building program, and toward national pooling of part of the funds. Of the $5,000,000,000 worth of private construction carried on annually, probably a greater proportion than formerly is now handled by means of building and loan associations, life insurance companies, savings banks, and other banking institutions, and less by personal transactions between the building owner and the lender. The increased rate of growth in building and loan associations and the passage of the McFadden Act in 1927, which permitted national banks to invest as much as one-half of their savings deposits in realty loans for periods up to five years, have been notable. Financing of large apartments, hotels, and office buildings, by means of mortgage bond issues, which have averaged more than $300,000,000 annually for several years, is largely a development of the postwar period. Corporations have the national investment security market more readily at their disposal for financing capital expenditures. Exemption from Federal income taxes of interest on local government securities has enabled local governments since the war to finance at lower rates public buildings and works, amounting to more than $1,500,000,000 annually.

The net result of all these tendencies is that communities in which there is an immediate demand for new construction can call more readily on national sources for investment funds.

Rents and Vacancies.—Rents and vacancies, two related factors, affect the amount of construction of apartments, hotels, office buildings, and dwellings. Immediately after the World War there was a general shortage of such buildings, vacancies were abnormally low, and rents were rising. But the response to these conditions was decidedly uneven.

Local Conditions.—The total amount of construction in a city or region depends upon many local factors, such as the prosperity and rate of growth of its industries and local rents and vacancies. The peaks in building in Southern California in 1923, in Florida and Philadelphia in 1925, in New York in 1926, and in a number of smaller cities in 1927 illustrate these tendencies.

Conditions Affecting Various Classes of Construction.—Obviously different classes of construction are subject to different influences. Some types of industrial buildings showed an increase in 1921, in spite of the prevailing drastic declines in most other lines. Single family houses, apartments, and hotels have shown many differences in movement. Public works and utilities construction, after an initial spurt in 1919, was slower than other types in getting under way after the war, but has increased more steadily in amount than most other important types of building since that time.

General Business Conditions.—General business conditions have exerted a strong influence on the amount of new industrial building, which fell off strikingly in 1924 and 1927. Some of the other public utilities and public works construction, of which roads are the principal element, have been but little subject to the fluctuations in business conditions since 1923. How far they would be subject to major economic disturbances, or whether or not distinct changes may develop in their secular trend, are other questions.

Although a severe business depression undoubtedly would reduce the amount of building in most localities, the fact remains that abundant credits have not resulted in an inflationary building boom—a frequent percursor to a depression. More mobile capital funds, adequate supplies of building materials, and dependable transportation have made it possible for cities or regions to carry on an unusually large amount of construction without cost inflation, and local recessions in building have ordinarily followed from local conditions other than inflated costs, or insufficient capital funds.

Developments in the commercial banking field might at some time withdraw enough funds from the investment field to retard, for a time at least, building throughout the country.

TABLE 5.— INDEX NUMBERS RELATING TO VOLUME OF CONSTRUCTION AND CONSTRUCTION MATERIALS

(1923 = 100)

Items	1919	1920	1921	1922	1923	1924	1925	1926	1927	1928
RELATING PRIMARILY TO TOTAL CONSTRUCTION										
Construction contracts awarded										
36 states, value		.	.		100	112.7	146.2	154.5	152.8	160.9
36 states, floor space				.	100	102.9	130.8	123.4	118.3	135.7
27 states, value	73.8	72.5	67.5	95.7	100	111.1	144.2	155.0	156.6	167.0
27 states, floor space	94.5	67.9	65.4	96.9	100	101.5	128.8	125.2	122.1	141.0
Building permits—168 cities, value		46.2	53.6	82.0	100	103.8	122.0	114.9	101.8	99.3
Portland cement, shipments	63.3	70.6	69.9	85.8	100	107.3	115.3	119.0	125.8	127.9
Fabricated structural steel	80.3	84.3	55.7	105.8	100	120.3	138.3	127.9	132.4	[a]
RELATING PRIMARILY TO HOUSING										
Residential construction, contracts awarded										
36 states, value			.	...	100	118.1	153.9	148.5	143.6	156.5
36 states, floor space			.	..	100	107.3	137.5	126.9	120.5	139.6
27 states, value	53.7	35.8	55.4	85.1	100	116.4	149.1	147.8	147.0	161.2
27 states, floor space	68.3	38.8	57.7	87.9	100	104.8	132.7	127.1	122.7	143.4
Number of families accommodated (based on permits)		.	49.5	83.2	100	97.6	108.3	102.0	89.5	[a]
Baths, shipments	38.3	56.9	45.9	82.8	100	105.4	122.2	110.2	104.4	102.8

[a] Not available

Sources: Construction contracts awarded, from reports of the F. W Dodge Corporation. Building permits, Federal Reserve Board Number of families accommodated in dwellings for which building permits were issued, Bureau of Labor Statistics, Department of Labor. Portland cement shipments, Bureau of Mines Fabricated structural steel and baths, *Survey of Current Business.*

Has Building Been Overactive?—Has the active construction during recent years been due to filling up the deficiency created during the war and the postwar economic disturbances? Or has there been overbuilding, or building of a premature character, so that the country cannot long proceed with such large programs? The discussion of various types of construction in succeeding pages is designed to throw some light on the answers.

From a national point of view, investment in actual physical capital appears to have been within the savings funds available, and studies by Dr. Willford I. King indicate that construction now represents a smaller part of the national income than during the prewar period. But his studies also indicate that building construction, when considered as depending on the population, and annual increments to it, has been relatively high since 1924.

It is difficult to compare construction volume between periods by physical measures based on the production and use of building materials.

Shifts between hollow tile and brick for certain purposes, plasterboard instead of lath, changes in design such as lower ceiling heights, thinner brick walls, lighter steel and concrete structural members, and more complete equipment, all combine to make a smaller quantity of basic materials go farther, and allowances for salvaged materials are uncertain. But the figures in the following table show that current construction is not wholly out of line with prewar programs:

Per capita production	1913	1921	1926	Per cent change 1926 from 1913
Lumber (board feet)	395	249	317	−20
Common and face brick (number)	92	49	85	− 8
Structural steel (pounds)	69	27	76	+10
Portland cement (pounds)	357	342	530	+49

Sources of basic data.—Population estimates of the National Bureau of Economic Research, lumber production figures of the Bureau of the Census, Department of Commerce, and the Forest Service, Department of Agriculture, as published in the *Commerce Yearbook;* common and face brick production figures of the Bureau of the Census and Bureau of Mines, Department of Commerce, structural steel production figures of the American Iron and Steel Institute; Portland cement production figures of the Bureau of Mines, Department of Commerce

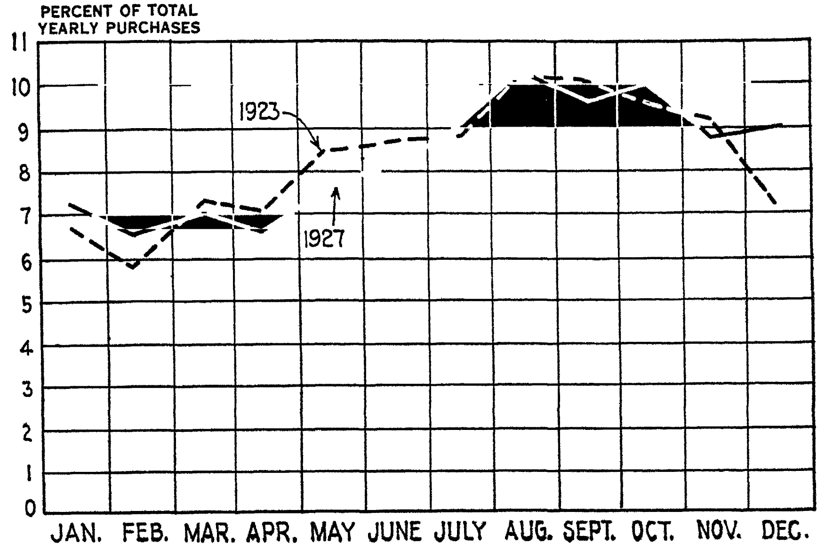
The decrease in per capita production of lumber and brick may have been offset by other factors such as the use of concrete and gypsum products, hollow building tile, and second-hand brick. The increase in cement consumption, which requires a corresponding consumption of sand and gravel, has been due in some measure to the increased use of concrete for building streets and roads. This gain may be considered as partly offset by the considerable decrease in the per capita consumption of steel rails from the years just before 1914.

Planning.—Relatively more construction than formerly is now definitely planned with reference to long-time growth in requirements. Construction by practically all types of public utilities, such as railways, electric light and power, gas, and telephone companies, is largely noncompetitive and nonspeculative. This may be contrasted with the highly speculative building of various railways during the last third of the nineteenth century, which so frequently led to receiverships.

Industrial corporations, more easily financed, have been able, for the past five or six years, to plan and finance developments without interference from general financial conditions. It is not so easy to say that long-time trends in demand for residential buildings and some types of commercial buildings are more carefully considered than formerly. There is, however, much more planning of a basic nature than before the war. The number of official city planning commissions has been multiplied several times. At least 206 of the 287 largest cities have such bodies at work on comprehensive plans for their future physical develop-

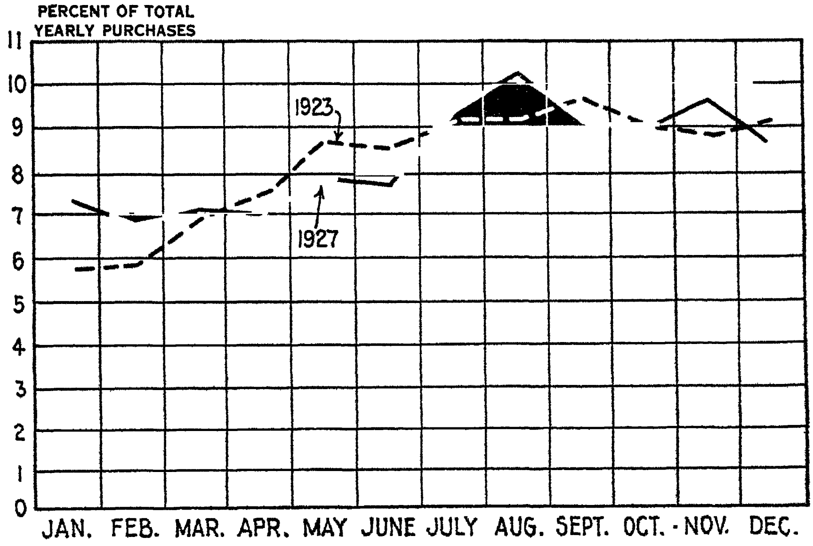
CHART 1.—MONTHLY EMPLOYMENT OF BUILDING LABOR. YEARLY TOTAL = 100

Source: Reports of contractors in 24 cities to Division of Building and Housing, Department of Commerce



MONTHLY PURCHASES OF BUILDING MATERIALS. YEARLY TOTAL = 100

Source: Reports of contractors in 18 cities to Division of Building and Housing, Department of Commerce



ment. Their long-term programs for constructing and financing public works help private owners to gauge the probable direction and character of growth.

Zoning ordinances are now in effect in more than 700 cities and towns, covering about three-fifths of the urban population of the country. Almost all of these have been adopted since the war and are helping to stabilize the character of particular districts and thereby encourage durable construction. Comprehensive city planning frequently leads to remedies for past mistakes, such as tearing down old structures in order to make way for new thoroughfares and the erection of large modern structures. Planning often emphasizes the logical necessity of large highway bridges, the relocation of passenger and freight terminals, and the undertaking of water supply and sewer developments.

Further evidences of broadly planned construction are the development of the national "Federal aid" highway system by the Bureau of Public Roads in co-operation with state highway departments, and the interconnection of electric power systems.

Group Efforts to Secure Stability.—At the same time, intergroup and community efforts to assure seasonal and long-time stabilization in building encourage owners to look ahead and formulate long-term building programs. These local efforts, recommended by the Committee on Seasonal Operation in the Construction Industries, in 1923 and 1924, have had the support of contractors, building material groups, architects, engineers, real estate groups, building-trades labor, financing agencies, and bodies representing owners.

Chart 1 shows for 1923 and 1927 the monthly distribution of labor pay rolls and receipts of materials by representative contractors in about twenty cities. The years 1923 and 1924 showed a distinct improvement in this respect over 1922.

Statistical analyses of present and prospective building activity have enabled building material manufacturers to plan their production and stocks more carefully, with less seasonal fluctuation in the number of workers employed.

II. TECHNICAL AND PRACTICAL TRENDS

No one can deny that there has been a tremendous advance in planning and carrying out road-building projects and other large engineering undertakings. In the case of buildings, particularly small houses, where the greatest criticism has been directed, distinct improvements do not wholly dispel the charge that the building industry has failed to keep pace with other groups in modernizing its methods. But the groundwork laid by the tendencies for construction to follow nation-wide, rather than purely local standards, undoubtedly forms a necessary basis for further advances.

Growth in Professions.—One indication of the increased appreciation and use of engineering data and technical skill is the growth in membership of professional societies, such as the American Society of Civil Engineers, the American Institute of Architects, and the American Society of Heating and Ventilating Engineers, several of which have more than doubled in membership since 1913, and some since 1919. There has also been a notable increase in the technical activities of trade associations in the construction industries, and in national and local co-operation between groups.

More Careful Design.—Structures are commonly planned more carefully for adaptability to use and economy in construction. For large structures the architects often collaborate with committees of experienced building managers. Architectural and engineering firms, assigning more important rôles to cost engineers, consult more often with contractors on economical features of design. Much construction is carried on by public utilities and large corporations, such as chains of stores and motion picture theaters, which employ specialists who work out plans with great refinement. Some of the larger mortgage bond companies also employ architects to pass on the design of structures and to suggest desirable improvements. Improvements in small house design include better lighting, heating, best insulation and ventilating, economy in the use of materials, regard for efficient construction methods, and for durability and appearance of the finished structure.[4]

Results of Competition in Building Materials.—Competition between the producers of various types of building materials has been keen, with many millions of dollars spent for group and association advertising and other forms of promotion, research, and engineering service. Quick-setting cements and mortar materials, wallboards, composition strip shingles, quick-drying lacquer paints, materials for heat insulation and sound deadening, and the evolution of dozens of varieties of floor, wall, and roofing materials illustrate the trends.

National trade associations, with annual budgets for research and promotion work running into the hundreds of thousands of dollars, are active in encouraging the use of Portland cement, lumber, steel, brick, hollow tile, and other materials. Building material retailers more and more have had to carry nationally advertised commodities and brands in order to meet the wishes of customers.

Standards for Materials.—Great savings have been effected in the use of materials through more careful analysis of strains and stresses, wider use of specifications, and better inspection, which permits greater reliance on uniform quality. There is a distinct and steady trend toward thinner masonry walls and lighter structural elements.

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[4] See Housing Standards, Chap. I, Consumption, p. 29; Chap. V, Marketing, p. 324.

The American Society for Testing Materials has adopted many new specifications for building materials.

The transforming of construction from a local to a more nearly national basis has been reflected in and stimulated by the adoption of simplified practice recommendations, which have recognized standard dimensional varieties for about fifty building material items, including yard lumber, common brick, hollow tile, concrete building units, metal lath and builders' hardware.

A standard filing system, established in 1916 by the American Institute of Architects, is finding wider use by manufacturers of materials.

Durability.—Increased durability of structures is emphasized by attention to fire-resistive features and use of noncorrosive metals. The amount of wood treated with preservatives to lengthen its useful life doubled from 1922 to 1927. The subgrading and substructure of highways is more carefully prepared, and the surfacing more lasting.

Better Organization and Reduced Time for Construction.—The execution of many more contracts of large size has been accompanied by improvements in the organization of many contracting firms. The time required for executing practically all types of construction operations has notably diminished, a development stimulated during the war and made possible by better planning and scheduling of work, improvements in design, increased shop fabrication of materials, more dependable delivery of materials, and wider use of labor-saving devices and equipment on the job. Groups of subcontractors have developed highly specialized organizations and their relations with contractors and designers have tended to become closer.

Improved Machinery.—Labor-saving machinery has been made more adaptable and reliable, and is more widely used.[5] Development of the gas engine has had a widespread influence. Motor trucks have left to horses only a small share of the hauling of materials, and have also cut into the use of light railways for filling operations. Gas engines have made possible a much wider use of compressed air furnished by small portable motor-driven units, and they and electricity are displacing steam in power shovels. The motor truck with its self-dumping body is displacing the wheelbarrow and common labor, in the assembly of materials in the hoppers and skips of concrete mixers and pavers. Standardization of ratings of capacity, and other features of mixers and pavers, has been effected by the co-operation of the manufacturers who in 1923 organized the Mixer Manufacturers' Bureau, affiliated with the Associated General Contractors. This now represents nearly 100 per cent of the machine

[5] See Mechanization, Chap. I, Consumption, p. 52; Chap. II, Industry, Part 1, p. 84, Part 2, p. 104; Chap. IV, Transportation, Part 1, p. 262; Part 2, p. 312; Chap. V, Marketing, pp. 324, 328, 350; Chap. VI, Labor, p. 483; Chap VII, Management, p. 511; Chap. VIII, Agriculture, pp. 551, 557–572.

capacity in both classes of mixers. The greater mobility and capacity of motor trucks have stimulated the use of power shovels on a greater number of jobs and kept larger shovels at work a greater portion of the time.

Many devices have been perfected for cutting down labor at the building site, particularly in the use of concrete and masonry materials, where there are material-handling problems.

Field studies show a more general rental of construction machinery and equipment, even by the large contracting firms. This practice has tended to reduce overhead carrying costs and transportation charges, and has encouraged and made available at less cost the use of the most efficient types of equipment.

Public Regulation.—The modernization of municipal building regulations has been accelerated. The enactment of zoning ordinances in more than 700 municipalities has already been mentioned.

The Department of Commerce Advisory Committee on Building Codes has been at work since 1921 on recommended requirements for municipal codes, co-operating with many other groups. Its findings have been used in code revisions in at least 120 municipalities.

National trade associations have extended their work of securing fair treatment for their materials in building codes. Several new associations have appeared in this field.

The Building Officials' Conference has gained in membership and strength. Corresponding regional bodies have been formed. Altogether, the framing and administration of building codes has come to be more widely recognized as a serious problem, to be solved by scientific research and engineering skill.

III. TRENDS IN VARIOUS TYPES OF CONSTRUCTION

In this section of the chapter, the portion on housing devotes particular emphasis to single-family houses, that on large buildings to office buildings, and that on public works and utilities to road building.

Housing Construction.—The construction of single dwellings and of multifamily apartments represents two distinct developments during the period covered by this survey, both of which are related to other economic and social changes. One- and two-family dwellings (the latter of declining importance in recent years) accommodate more families and are more important from the social point of view, because they house the great bulk of families in which there are children of school age and younger. In relation to the nine-year postwar average, construction of single houses made a quicker start in 1919 than the construction of apartments and held up better in 1920 and 1921. Families who had to find accommodations used their capital and credit to acquire homes, taking the risk of a possible fall in prices, where investors hesitated to erect apartments.

The postwar construction of one-family houses reached a peak nationally in 1925, a year prior to a peak in multifamily structures. One-family dwellings, when not erected by the occupant, are almost always erected for sale rather than for rent. Overbuilding of this type, in advance of immediate demand, has resulted in various cities in violent curtailment of programs, such as a 50 per cent reduction from one year to the next, but growth in demand has usually resulted in a fairly rapid recovery of more normal conditions. Careful surveys of annual vacancy were found by field investigation to stabilize this type of building fairly well in Utica, N. Y., and similar surveys are being undertaken in a growing number of cities. Overbuilding of apartments which are built to rent apparently does not have such an immediate effect upon new construction; even where new apartments are not needed they may be partly occupied, and they may be sold to investors who are not well informed as to local conditions. Where rental surveys have been made, they usually reveal a considerably higher percentage of vacancies in apartments than in houses.

It is not strange, all things considered, that relative to the nine-year local averages residential building was slow from 1919 to 1921 in New York and Chicago, where the building of multifamily structures predominates.

The desire of families to live in more satisfactory homes and surroundings has been the force behind the large home-building program. As has been customary, the new houses erected in and around cities have been for families in the upper income groups, with comparatively little construction for families in the lower groups which, for the most part, occupy older, less desirable structures. Many of the features which make the newer homes more desirable are made evident in succeeding paragraphs dealing with changes in the design, structure, and equipment of houses.

The private automobile and the bus, with improved roads, have greatly enlarged the area within which dwellings may be located, and have permitted comparatively open developments in attractive locations, to an extent that would not have been possible before the war. The demand for outdoor recreation favors the home situated away from the center of the city. The family's enlarged radius of movement due to the automobile, together with the neighborhood movie, the radio, and shorter working hours, strengthens the call toward the suburbs.

In many cities the percentage of vacancies in run-down and undesirable dwellings, particularly in congested districts, has been mounting during recent years. It is reported that the diminished number of new immigrants has much to do with this situation. In a number of cities the construction of shacks or other forms of cheap temporary dwellings, such as occurred soon after the war, has practically ceased.

Although the lowest priced new houses being erected in many cities are out of reach of most families having less than average incomes, they represent improved minimum standards as to light, air, and sanitary facilities. This is likely in future to be reflected in better housing conditions, for the worst accommodations in use to-day are usually structures which, when erected, were far short of meeting the present minimum standards for new dwellings. Owing to the desire of well-to-do families to move into more modern quarters, families less well-to-do may in effect receive a subsidy through their ability to obtain second-hand houses at a discount greater than actual depreciation. A problem may arise as to the use of land now occupied by the poorer types of houses which are now being vacated.

Home Ownership.—Although the percentage of home ownership has declined during each decade for which records are available, the decline from 45.8 to 45.6 per cent from 1910 to 1920 was less than in any preceding decade. A strong counter tendency appeared in many cities, and the percentage of families owning their homes in the 68 largest cities actually increased from 1910 to 1920. Fifty-five of these 68 cities showed an increased proportion of home owners in 1920 compared with 1900, while only 13 showed a decrease. Yet these figures do not take account of the increase in homes owned beyond the territorial limits of cities.

Business men and social investigators almost all agree that the preference or custom of owners to sell rather than to rent, which became strong during the World War and immediately after, has resulted in a much increased percentage of home ownership.

On the other hand, the proportion of families living in apartments has increased owing to the character of postwar construction. Apartments co-operatively owned can hardly be considered important as yet from a statistical point of view. It may be observed, however, that home ownership is of the greatest importance to families in which there are minor children, and that apartments are predominantly occupied by other types.

Construction of Houses.—Much of the attractiveness of new houses is owing to their design and construction. What follows is an account of changes observed during field investigations. These changes also throw light on the intensified competition among different building materials and reveal a tendency to use materials which leave the factory in such shape as to require little labor on the building site.

Design.—There have been changes in fashion in the architecture of houses, with marked improvement in some, particularly those selling above $10,000 or $12,000. There are many evidences of improving taste, and efforts on the part of builders to meet it, for the less expensive houses.

There has been a large increase in the circulation of architectural papers and of periodicals devoted to home building, home furnishing, home equipment, and landscaping. One such periodical established in 1922 has approximately 900,000 circulation. Publication of house plans in women's magazines has been stimulated by newspaper syndicates, two of which furnish material for home-building pages with circulations of several million a week. The Architects' Small House Service Bureau, formed in 1920 through the American Institute of Architects, has done much to encourage the appreciation and use of good designs for small houses, and numerous building material groups have issued plan books of improved quality. The garage usually receives attention in new subdivisions and in laying out the lots. It may accommodate two cars, and in more expensive dwellings it is often built-in, or attached to the house. The house itself is smaller, except for the living room, and may even omit the dining room; but it is vastly better equipped and usually better built. Hardwood floors in living quarters, linoleum in the kitchen, built-in bathtubs, and tile floors in bathrooms illustrate developments which, among other advantages, make housekeeping easier.

Lumber is still the basic material for dwelling construction since it is prevailingly used for interior framework, floors, stairways, and exterior and interior trim, even in houses whose walls are built of other materials. At some points, however, there have been inroads upon lumber by other building materials.

Intense competition is evident in roofing materials where composition strip shingles, which require but little labor for erection, compete with wood and other types. Copper, zinc, asbestos, slate, burnt clay, and cement tile all find some use on sloping roofs; while roll and built-up composition materials compete with types of sheet metal for flat or low-pitched surfaces. Copper and copper bearing steel vie with plain galvanized steel sheets for gutters and downspouts.

The walls and interior partitions of houses represent another field of rivalry. Under the weather surface, composition boards made from sugar cane refuse, or wood pulp and gypsum, compete with wood sheathing, and any of these may compete with common brick or hollow tile as a backing behind an outer course of brick. For interior wall surfacing, wood and metal lath with two or three coats of plaster have to compete with plasterboards to which one or two coats of plaster are applied. Some of the newer materials do not cost less in total, although they reduce costs on the job.

Perhaps the greatest and most marked improvement is in plumbing, with a tendency even in the moderately priced house to increase the number of fixtures and bathrooms. Lavatories are often installed on the first floor and in the basement. The grade and quality of the fixtures have improved as in the case of the built-in tub which formerly was installed only in the rich man's house but is now found extensively in houses selling for $8,000 and even less. The old-style tub on legs is difficult to find except in the cheapest new houses. Chromium plating is used on plumbing fittings. Colored and acid-resisting plumbing fixtures and colored tile have been introduced and are finding their way down from the more expensive to the cheaper houses. Weather stripping and materials for heat insulation make houses cooler in summer and help to reduce fuel expenditure in the winter.

Built-in ironing boards, increased use of kitchen cabinets, and the electric refrigerator are types of aids for the housewife. Entrance doorways, doorframes, and other millwork are available in somewhat improved stock designs. Electrical installations include more base and wall plugs, and heavier wiring to accommodate the use of electrical appliances.

Although it cannot be said that the building of houses is appreciably less of an individual undertaking than before the war, or that the building of houses on a large scale has made a positive contribution to improved technique, the national advertising and distribution of building materials have had a pronounced influence. Co-operative research and promotion, carried on by trade associations and large individual manufacturers, have contributed to the evolution of new materials and of better adapted uses for old materials. Economical production has been made possible in a number of instances by large-scale manufacture.

Two-family Houses.—Construction of two-family houses, which occupy a position between single houses and multifamily apartments, reached a peak in 1923 and 1924, when in 257 cities they accommodated about one-fifth of the families provided for by all new construction. Since that time they have steadily diminished in importance, being less than one-seventh in 1927.

Apartment Houses.—More than one-half of the apartment houses erected during the postwar period are in the New York and Chicago metropolitan districts. In general they have been built mainly to meet the needs of families without children of school age. They fit in with the economic independence of single women, and with the increased ease of keeping house for small family groups. The restaurant and tea-room, the delicatessen, organized facilities for social recreation, the motion picture, the submergence of the boarding house, and the relief of apartment dwellers from the personal responsibility for maintenance, care of grounds, and looking after the furnace, all tend to offset the advantages of living in larger housekeeping units in detached houses. Furthermore, apartments which house more people in a limited space provide more convenient locations.

Of the housing accommodations outside of New York and Chicago which were provided by new construction in 1926 and 1927, probably less than 30 per cent were in multifamily structures. This percentage is considerably smaller than the percentage of families having no children, or having only one child of school age or younger. The garden apartment specially designed for families with children, and situated on low-priced land with ample space around it, has not been tried out extensively.

The newer construction usually obtains proportionately higher rentals on account of its freshness, improved equipment, and arrangement of space. Ceiling heights are lower, on the whole, and mechanical refrigeration is much advertised.

Nonresidential Buildings.—Commercial structures, including offices, banks, stores, warehouses, and garages, form the largest single group of nonresidential buildings. Of these, offices (the most important subgroup), which are built mainly for rent, have shown the greatest fluctuations from one year to another. The floor space represented in contracts for new industrial buildings, which consist mainly of manufacturing plants and are next in importance to commercial buildings, was more than twice as great in 1919 and 1920 as in any two of the seven succeeding years. Such contracts showed a marked recession in 1924 as compared with 1923, and in 1927 as compared with 1926.

"Social and recreational" and "religious and memorial" buildings have shown a fairly consistent and generally upward trend since 1919. Educational buildings, hospitals and institutions, and public buildings taken together have shown reasonable stability since 1922.

Large Buildings.—Large buildings have been the most distinctive feature of postwar nonresidential construction. Although many had been built before the World War, they have since assumed great importance. Office buildings, department stores, hotels apartment houses, and schools have tended toward larger units.

Large buildings permit a better utilization of land area, and in general are more carefully planned than small ones. It has paid to work out design with refinement of detail, in order to secure economical construction and to make structures convenient, comfortable, and attractive to tenants. Building of large structures has helped stimulate research into the properties and uses of materials. It has developed more contracting firms with better organizations; it has improved and made more widespread the use of construction equipment and machinery on the job. Erection of large buildings has called for the solution of complex engineering problems, and has thus kept pace with the growth of technical societies. It has also called for the services of many highly skilled building craftsmen.

Office Buildings.—The erection of large office buildings has been one of the striking developments in this field and emphasizes the significance of the greater size of structures. They make a certain appeal to pride; the organization which owns one gains prestige and advertising; the tenant likes to be known as occupying a large well-known building; and citizens feel that large buildings are a symbol of progress. On the other hand, high buildings have brought recognition of the dangers of congestion which follow intensive development of land without allowing enough open space for traffic, light, and air. These dangers have been recognized in hundreds of communities in the height or bulk restrictions of zoning ordinances. Some recognize that a high building may not be objectionable from a community point of view, if it has enough space about it so that it does not shut off too much light and air from neighboring property, and if street and other transportation facilities are adequate. The setbacks required above a certain height by the zoning ordinances of New York and other cities have resulted in a new type of architecture, often used even where not required. Zoning ordinances often put a premium on buildings covering a large area which can take the best advantage of setbacks and other provisions for light and air.

Capital required for large offices comes sometimes from local banks and corporations, and sometimes from individual investors. National sources of investment funds are also drawn upon, particularly for first mortgage money. Insurance companies have found mortgage loans desirable, and mortgage bonds based on such security have been made popular by investment banking concerns and mortgage bond houses.

Although office buildings are usually undertaken after a thorough analysis of probable demand, there have been complaints that many have been constructed because a promoter, a contractor, and a mortgage bond company want business and put up structures for which there is too little demand. Occasionally promoters have financed practically the whole cost of the undertaking through securities sold to the public before construction was commenced. In some such cases, they have realized handsome profits; in others, investors have suffered loss. Such abuses involve two related dangers—loss to investors, and the danger of overbuilding.

The annual retirement of a certain portion of the principal of each issue of mortgage bonds is customary and affords some protection to security holders. In general, the total losses to security holders have not been alarming. It is not yet possible to give a ready answer as to the extent of overbuilding of office structures which may have taken place in various cities. Reports of the National Association of Building Owners and Managers indicate vacancies of over 15 per cent as not uncommon.

On the whole, the newer structures appeal to tenants on account of modernized features and convenient location. They are usually better designed from the point of view of modern office methods, have modern high-speed elevators, and are better equipped for the comfort and convenience of tenants. As in the case of houses, vacancies in new structures are of greater significance to the building industry than those in obsolete buildings.

Methods and Materials of Construction.—There has been a widespread application of good methods of construction. Better management in the case of large building is reflected in the decreased time required; perhaps 30 or 40 per cent less than before the war.

Reinforced concrete, something of a curiosity for an office building in 1910, has become common and competes with steel for structures 12, 15, and even more, stories in height. Reinforced concrete structures are more often economically designed, partly because increased knowledge of the properties of concrete and better control of the proportions of mixtures permit greater reliance on the strength of the finished concrete. The "tin-pan" or "dome" method of constructing concrete floors saves much material, and its use has been promoted by standardization of sizes of the metal forms. Removable and adjustable shores and other labor-saving devices for installing and removing wood and metal forms have been improved and can be leased from specialized concerns.

For steel frame construction, the allowance of a basic working stress of 18,000 pounds per square inch instead of 16,000 pounds—which had been standard in building codes for about thirty years—now permits, in many cities, a saving of approximately 11 per cent in the amount of steel required for a given structure. This change was recommended by a committee of consulting engineers employed by the American Institute of Steel Construction, which was formed in 1922, and by the Advisory Committee on Building Codes of the Department of Commerce.

There is more building of steel frame and reinforced concrete buildings during the winter months, with swinging scaffolds and tarpaulins protecting masonry workers as the walls are filled in.

The devices for anchoring brick and stone work have been improved. Partitions made with quick-setting mortars, or with steel framework, covered with composition boards which take the place of sound-deadening felt and lath, and are finished with quick-setting plaster, are aids to rapid work.

Although contractors report that the value of equipment required for a job has not greatly increased, there is some use of paint spraying machines and wider use of power saws, floor scrapers, and electrical drilling and cutting apparatus of other types. One contractor reports that satisfactory portable air compressors have trebled the use of pneumatic tools during the nine-year period.

The material storage bins used on large jobs have been given up in many cases[6] because of the more general establishment of well-equipped sand and gravel producing plants, and the longer hauls which can be economically undertaken by modern dump trucks, with dependable, accurately timed deliveries on the job.

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[6] See Size of Inventory, Chap. II, Industry, Part 1, p. 91; Chap. IV, Transportation, Part 1, pp. 267, 292, 302; Chap. V, Marketing, pp. 332, 344, 350; Chap. VII, Management, pp. 508–509

Architects, engineers, and builders, interviewed during the course of this study, agreed that the spread between building-trades wage rates and material prices which has taken place since 1913, and even since 1923, has not meant a corresponding increase in the ratio of labor to material costs in the construction of large buildings. Several well-qualified men believe that the ratio has not gone up perceptibly. The reasons assigned are the use of labor-saving equipment, less loss of time on account of poor management, occasional use of laborers for unskilled work formerly performed by more highly paid craftsmen, the tendency to finish materials more completely before they arrive at the site, and the use of more expensive materials at some points. It requires no more work, for example, to install brass pipe than the less expensive steel.

Miscellaneous Commercial, Recreational, and Industrial Buildings.—The construction of cold-storage warehouse buildings has been an important item in the commercial building field. The chain store, a common feature of neighborhood shopping centers, often occupies a structure planned by a large centralized organization. The construction of automobile service stations has been promoted by competition among the large oil refining companies. Automobile sales rooms, accessories stores, repair garages, storage garages, and radio sales shops, all serve to illustrate the demand for new commercial buildings which may be created by new or rapidly expanding industries.

The enormous growth of the motion picture industry has involved a corresponding demand for theaters. A striking feature in this connection has been the consolidation of local theaters into nation-wide chains, with the application of more careful analysis to the planning and design of new structures of this type. Great advances have been made in planning the acoustics of auditoriums.

Increased leisure and income have also resulted in greater construction of athletic fields, stadiums, gymnasiums, swimming pools, and golf courses.

The total construction of industrial buildings is still liable to considerable fluctuation from year to year, but since 1922 there have been no such wide swings as during the three preceding years. Considerable changes from one year to another still occur occasionally in single industries. In 1927, for example, the F. W. Dodge Corporation reported that new building contracts for the petroleum, lumber, and leather industries represented in each case less than half, in point of value of floor space, the respective amounts in 1926. Such changes appear to result from the free exercise of judgment of the business executives as to the best time at which to build, with less dependence than before the war upon current rates of interest, on temporary conditions in the money market, and on group psychology.

There is, of course, more general reliance upon electric power received from central stations, and less upon individual factory power plants, a fact making for stability in the construction of generating facilities. Building structures represent, on the whole, a decreasing proportion of the total investments in industrial plants, with machinery and equipment representing a growing proportion. Improvements in manufacturing processes in some instances diminished the amount of space required. Dependable railway transportation has reduced in many cases the amount of space required for storage of raw materials. Investments in equipment and storage facilities which permit the economical handling of materials appear to have been large.

Postwar industrial construction has been characterized by improved standards for lighting, ventilation, flooring, and working conditions generally.

The decreased time required for construction, without excessive payment for speed, has been of great importance in industrial buildings. Certain types are well enough standardized for design and construction to proceed expeditiously. One firm of engineers reports constructing in 280 calendar days a plant including 20 buildings, most of them 4 stories high and of reinforced concrete, at a total cost of about $7,500,000. One of these buildings of reinforced concrete, 800 feet long, 90 feet wide, and 4 stories high, was completed and turned over to the owners ready for installation of machinery in 44 calendar days.

Public Works and Utilities.—The construction programs of public works and public utilities during the postwar period have been notable not only for their actual and relative magnitude, but for the developments in planning, financing, and technique.

There has been little of the spectacular reaching out into undeveloped territories which characterized the decades of railway building during the last part of the nineteenth century, but rather the filling in and extension of facilities for transport and communication within areas already inhabited and beyond the pioneering stage.

From the point of view of business stability, the changed character of construction of this type is important because it is planned pre-eminently with a view to meet needs which exist or are readily predicted. The most striking developments in this field, namely, highways and electric power generation and transmission, have been conditioned on technical improvements, rising living standards, and large savings funds available for capital investment.

General Trends in Public Works.—Among the outstanding developments in the construction of public works during the postwar period may be mentioned more careful and comprehensive long-time planning based on surveys of needs, sounder financing, improvement in design

Table 6.—Public Works Construction of Six Types

(In thousands of dollars)

Class	1913	1919	1920	1921	1922	1923	1924	1925	1926	1927	1928
Total	192,893	398,152	406,729	459,042	521,079	630,424	685,673	719,212	811,741	932,703	1,049,353
Waterworks	20,778	19,762	22,141	38,330	36,221	62,698	61,445	69,368	61,647	53,189	99,437
Sewers	27,269	38,506	37,418	38,805	43,584	66,905	74,553	84,577	103,741	118,032	100,669
Bridges	22,629	27,144	33,801	29,730	43,477	66,985	68,564	69,876	83,383	143,645	129,078
Streets and roads	58,407	225,655	262,641	313,303	334,694	361,837	415,216	421,039	484,898	525,069	612,610
Excavation, drainage, and irrigation	22,059	14,710	14,166	10,270	19,551	24,059	27,010	40,080	27,810	42,005	37,660
Federal Government	41,751	72,375	36,562	28,604	43,552	47,940	38,885	34,272	50,262	50,763	69,881

Note.—Minimum cost of projects listed in this table are as follows. waterworks, excavation, drainage and irrigation, $15,000, other public work, $25,000, Federal Government, $150,000.

Source: *Engineering News-Record.*

from a professional and technical point of view, and better machinery and equipment.

Authorities issuing municipal bonds have demonstrated that they take advantage collectively of temporary fluctuations in the investment securities market which enable them to obtain low rates of interest on their offerings. This fact may be significant in connection with the movement to stabilize general business conditions by the timing of public works.

Road Building.—Planning and Finance.—Not long before the World War the United States was considered backward in respect to its improved highways. The few well-surfaced highways had been planned and constructed by counties and even smaller governmental units, mainly with reference to local needs, without much effort at co-ordination and often with none too good construction or maintenance. The development of one of the finest systems of improved roads in the world has been effected mainly since the World War and has parallelled the increase in number of automobiles. More than a billion dollars annually is now spent for the construction and maintenance of rural roads, and another $400,000,000 or more by cities for street improvement and maintenance. From 1890 to the outbreak of the World War there was a gradual awakening to the need for improved roads, and some states established highway departments during that period. In 1916, the passage of the Federal Aid Highway Act required all the remaining states to create highway departments in order to take advantage of its provisions. The Federal Bureau of Public Roads, in co-operation with the state authorities, worked out a well co-ordinated network of 185,772 miles of principal roads throughout the country, of which about one-third has been improved.

There remains much room for better planning of highway improvements, for in many states there is too little co-operation between the authorities in adjoining counties, and between the authorities of cities and those of neighboring rural territory. In some cases the state highway authorities are able directly or indirectly to secure reasonable co-ordination. Ten or twelve regional planning bodies, all created since 1922, are doing excellent work. Sound financing of outlays for highways has been encouraged by the highway departments of a number of states, and also by the investment bankers in their individual capacities and through their association.

Administration.—There has been a striking improvement in the administration of road building and maintenance. State highway departments have come more often to recognize the advantages of letting contracts at times which permit a maximum working season. They have learned to let out the work in units of suitable size for a season's work by a road building outfit. Co-operation with organizations representing road builders has resulted in improved documentation, including not only contract forms but questionnaires to establish the competence and responsibility of bidders. A number of state highway departments now centralize the purchase of cement and other road building materials and provide for their use by contractors.

Types and Specifications of Roads.—More careful study of the need for rural roads has resulted in a careful planning of types of surfacing and subsurfacing for the amount and character of traffic. There has been a great improvement in the grading and maintenance of the earth, gravel, and sand-clay roads, and there is a much better understanding of methods or proportioning such surface materials. Water-bound macadam and sheet asphalt surfacing are yielding to other types. The total mileage of concrete roads was increased from 7,000 at the end of 1918 to 50,000 at the end of 1927. Several state highway departments maintain research departments and, with a number of trade associations and professional societies, they have co-operated with the Bureau of Public Roads in its research program and in the co-ordinating activities of the National Board for Highway Research. One result of research has been an almost universal change, effected since 1921, from the practice of having concrete surfacing of uniform thickness, or thicker at the center, to the present practice of having it thicker at the edges. A number of state highway departments in co-operation with state universities conduct annual road schools for the personnel of the state, county, and township highway departments. On the whole, inspectors now are carefully trained. Good maintenance standards for local roads are often encouraged by the conditions under which state aid is granted.

Construction Methods and Equipment.—Although no new methods for cutting and filling and preparation of the subgrade have been developed within the past ten years, there have been constant improvements in the machines used for such purposes—improvements comparable in some ways to those in passenger automobiles, representing greater reliability of performance, ease of handling, and accuracy, and increasing the amount of work which may be accomplished.

The *Engineering News-Record* gives a number of concrete instances which illustrate recent developments in the equipment used for road building and other engineering projects:

> The usual power shovel in 1920—then it was invariably a steam shovel—had a boom and a dipper stick, but little else that we recognize on the modern machines. There were few crawler units, and those that did appear were of fragile construction. There were no alloy-steel dippers, no unit-cast steel frames, no cut gears running in oil. A choice of power plant, to all practical purposes, did not exist. Now, electric motors and steam, gasoline, or Diesel engines may be had. And a power shovel is no longer just a shovel. By removing a few bolts and re-reeving the lines, it becomes a crane or a dragline. In the old text books and magazines we look in vain for the finished mechanism that is the modern road paver. The tractor of 1920 was more

often than not a miniature threshing engine, from which the modern tractor differs so radically that it can hardly be said to be an adaptation from these earlier models This development has taken place in less than a decade—in construction terms, during the handling of three or four large jobs.

There has been much advance in the methods of handling and storing materials. Contractors have the choice of light railways and of motor trucks for hauling materials. The materials are frequently placed in storage and are loaded into trucks or cars by gravity. On concrete road-building operations the truck bodies are frequently divided into compartments into which a proper mix of sand and crushed stone is placed. Sacks of cement are emptied over the aggregates, often while the truck is turning, before it dumps the successive batches into the skip of the paver. The paver has a swinging horizontal boom to convey each batch as it is mixed to the proper point for dumping. Compared with prewar methods, when the hopper of the concrete mixer was filled from wheelbarrows, the changes are no less than revolutionary.

A typical gang for constructing a concrete road, consisting, under methods in use before 1919, of about 74 men, would construct up to 350 feet of pavement per day; in 1928 a gang of 45 men would often construct 800 feet of pavement per day. Accepting these estimates, which have been judged reasonable by several competent engineers, the daily output per man increased from 4.7 to 17.7 lineal feet of road surfacing. Accompanying the changes in methods, contractors have had to increase the amount of equipment required for road building, and its value now commonly amounts to from 35 to 50 per cent of the value of the season's contract. Some of this equipment is purchased on the installment plan and some of it is rented, although many contractors purchase their equipment outright. Reports by the Bureau of Public Roads indicate that the increase in road-building activity since 1919 has not resulted in the employment of appreciably more men.

Vehicular Bridges and Tunnels.—Accompanying the great increase in road building, there has been—particularly during the past three or four years—a great expansion in the building of large vehicular bridges and tunnels at strategic points. Many of these have been constructed as toll bridges by private companies and by public authorities, and are thus expected not to become a direct burden upon taxpayers. All of these bridges occasion construction of other types, including highway approaches; and those in or near cities usually result in many new buildings erected to take advantage of increased site values.

Airports.—The development of airports, including the grading and drainage of sites, surfacing of runways, lighting, and construction of hangars and accessory buildings, represents virtually a new type of construction which has been undertaken recently in hundreds of American communities.

Miscellaneous Public Works.—The percentage of the population furnished with running water has continued to increase, and cities have had to carry out large engineering projects in order to take care of increasing demands for water. Improvements in methods of treating sanitary water supplies have resulted in the reconstruction of many local plants for treatment of water. These tendencies seem likely to continue. The satisfactory treatment and disposal of sewage is assuming considerably more importance as cities grow larger and the problem of stream pollution becomes more serious and more generally recognized. Adequate disposal of sewage has been regarded as a luxury rather than a necessity by a considerable proportion of the public and their representatives—at least when it comes to an outlay of money for such purposes—but the general tendency is toward enlarged expenditures for sewers and sewage disposal plants.

The construction of fire-engine houses and police stations and other public buildings has shown a comparatively steady growth, although this is not an important branch of construction. There seems to be some tendency to place less reliance on liberal use of space as a means of lending a distinctive character to public buildings and more reliance on excellence of artistic design and improved setting.

Educational Buildings.—The enormous school building programs of the postwar period have been brought to the forefront by the increasing proportion of young people attending high school and college, and by the consolidation of rural schools. The students come to school by automobile or bus, a development closely connected with the increase of automobiles and improved highways. Many school buildings are now expected to be of a monumental type and to have fairly elaborate special facilities for laboratory and manual training work and gymnasiums, swimming pools, and other features for physical training and recreation. It appears to be the prevailing view among boards of education that they have hardly been able to take care of the great increase in school enrollment, and that there are still in many cities large numbers of schools which do not meet present-day standards for lighting, ventilation, equipment, or play space. There has been an undeniable improvement in the design of school buildings and many architectural firms have gone carefully into the matter and have handled school buildings as a specialty. Careful surveys of the community's needs are usually made before going ahead. There appears to be general knowledge on the part of responsible local authorities of developments elsewhere throughout the country, and this in turn leads to a general demand for the best that can be obtained. The value placed upon education, which is evidenced by the increased number of families whose children go to school, and the excellent market for tax-exempt securities with which to finance school construction, appear to have contributed toward the large programs. There has been little public opposition to expenditures made for school buildings.

Hospitals and Institutions.—The increased construction of hospitals and other institutions has resulted apparently from a wide realization of the value of specialized plant and equipment for handling patients. This has been occasioned partly by the advance in elaborate facilities for diagnosis and treatment of disease, such as the X-ray, bacteriological laboratories, pulmotors, and hydrotherapy. At the same time, the smaller living quarters occupied by many families have increased the difficulties of caring for disabled persons in the home. Hospitals have characteristically received splendid support from private contributions, and the general prosperity during recent years has resulted in increased private as well as public donations for the erection of such buildings.

Public Utilities.—The enormous development of the electric power industry, both in generating stations and transmission and distribution lines, is an outstanding feature of the last decade, the fundamental causes of which include the discovery and application of more economical methods of long-distance transmission of power, distributing of loads by means of interconnection of stations, and a great reduction in cost of generating power through improvements in design. These developments are described in the chapter on industry.

From the point of view of construction, this development, involving the investment in new plant and equipment of more than $750,000,000 annually in the past three years, is important because it has been undertaken by companies of strong financial backing, most of them having a virtual monopoly of service within defined geographical areas, and having good reasons to avoid premature investments or duplication of facilities. Approval of projects by public service commissions serves as an independent check.

Gas companies, electric railways, and the telephone and telegraph companies have had like reasons for carefully planned expansion in line with growing demands from consumers.

The railways, under supervision of the Interstate Commerce Commission, and with the object of effecting economies in operation and providing facilities for growing traffic, have been making their investments in improvements of existing lines, including some construction of new terminals.

The public utility companies, with their skilled engineering departments, have taken a leading part in developing the use of labor-saving equipment. The motor trucks equipped with post-hole augers and derricks for placing telephone and telegraph poles are now familiar sights. The railways, telephone, and telegraph companies are the principal users of preservative-treated wood products.

Railways have been investing large sums in motor cars to carry gangs of men and loads of materials to their work. Another type of motor car with a gas-electric power plant develops electric current to operate electric tools, such as grinding wheels, portable rail saws, track bonding drills, electrical tie-tampers, flood lighting systems, portable saws, and electric driven air compressors. Ballast-cleaning machinery saves a considerable amount of labor. Joints and bolts are oiled by spraying machines, and weeds are destroyed by large burning machines. Air and electric tamping machines and ditching machines also reduce the cost of building, improving, and maintaining railway roadbeds.

Public utility companies operating in cities are large users of trenching machines and of various types of air tools in connection with cutting pavements, and laying and maintaining conduits and pipe lines.

From an economic point of view, the construction of highways and of the types of public utilities just mentioned may be compared with the construction of railways in the United States during the latter part of the nineteenth century, when there were extensions of lines into undeveloped territory, involving large speculative risks whose outcome was dependent upon uncertain factors as to the amount of traffic which might develop, and the time at which it might develop. Furthermore, at that time there was some competitive building of parallel routes not required to handle existing traffic. The public utility field now seems vastly more stable, from the point of view of new construction, than was the case a generation ago, or even just before the war.

IV. LABOR

There has been some tendency in the past decade toward reducing the number of hours in the working week, although 44 hours was common at the beginning of 1919. There has been some local lessening of longer weekly working periods, and within the past two years several crafts in a number of cities have gone on a five-day week of 40 hours. The president of the painters' union reported that 45,000, or one-third of its members, were working the five-day week at the end of November, 1927. The general tendency of building-trades wage scales has been upward since 1921, but too great reliance cannot be placed on these, as in some cases the wage rate may be only nominal and may be below or above the level of wages actually paid.

There has been no very marked trend, either away from or toward trade agreements which restrict employment on building operations to qualified members of trade unions.

The building trades since 1921 have been unusually free from labor controversies. Part of the comparative freedom from strikes has been gained through the operation of the National Board for Jurisdictional Awards in the Building Industry, representing employers, architects, engineers, and building-trades labor and formed in 1919. Although the labor representatives were withdrawn late in 1927, no important jurisdictional strikes have been reported since.

The advance in this direction virtually eliminated one of the most serious hindrances to stabilized building. A dispute as to which of two classes of subcontractors and mechanics should perform a certain class of work frequently tied up many entire projects involving thousands of other crafts not directly concerned, with great expense to owners, contractors, and the community as a whole.

Recruitment of skilled building-trades labor by immigration has notably diminished, and the industry has been faced with the problem of training competent mechanics. This problem has been met partly by infiltration of workers who have commenced work as journeymen on rougher types of work and gradually acquired experience and skill without formal apprenticeship or instruction. Efforts to encourage apprenticeship in certain crafts in the building trades have been made in a number of cities and have had the co-operation of the Federal Board for Vocational Education. The experience gained and the accumulation of a certain amount of teaching material are perhaps the most significant results of these experiments to date. Establishment of a national school promoted by the Associated Tile Manufacturers has afforded an outstanding example of what well-organized effort can accomplish.

V. GROUP, INTERGROUP, AND COMMUNITY EFFORTS

Group, intergroup, and community efforts to solve problems within the construction industries and in their relations to the public have distinguished the postwar period.

The American Construction Council, formed in 1922, represents the leading groups connected with construction. It includes architects; engineers; general contractors; subcontractors; construction labor; manufacturers of material and equipment; dealers in material and equipment; financial, surety, bonding, real estate, accounting, insurance, and building and loan organizations; chambers of commerce and boards of trade; public utility construction departments; representatives of Federal, state, county, and municipal bureaus or departments concerned with construction; and national associations of builders' exchanges and of building-trades employers' associations and similar associations or federations of building interests.

In several cities, building congresses, all formed since the war, bring together similar groups, including building-trades labor. Several have been particularly concerned with seasonal stabilization, and some have done much to encourage craftsmanship by awarding to mechanics medals and certificates of craftsmanship.

There have been, as already mentioned, successful efforts to promote seasonal stabilization of building activity, city and regional planning, improved documentation, modernized building codes, more careful selection and economical use of building materials in design, better workmanship, and elaborate research into such matters as the capacity of heating apparatus for buildings of various types. As the membership of trade associations and technical societies has increased, results scientifically established have come quickly and widely into use. Development of simplified practice recommendations and standard specifications has brought many groups together.

As such efforts have become common, the different groups within the construction industries have become mobilized and have come more and more under the public eye. At the same time, there is less indication of collusive control of prices locally—one of the great banes of the construction industry at various times in the past.

The common use of nationally advertised commodities has helped to make it harder for prices to be raised by local collusion, and the intensified competition between materials has had something of the same influence.

VI. SUMMARY

A sustained high rate of construction activity has distinguished the period since 1922 and has contributed to steadiness in many other nationwide industries, such as railway transportation and the production of building materials. This stability in total volume of construction has been achieved in spite of ups and downs in individual cities and regions, shifts among various classes of construction, such as residential and public works, and building costs which have been higher than the general price level when compared with prewar conditions.

Construction has become more national as to standards, and more independent of local financial conditions. More of it is well planned not only from the point of view of architecture and engineering, but with reference to location and probable demand. The various groups which make up the industry are better co-ordinated among themselves and more co-operative with other groups.

Both in design of structures and in construction methods, there has grown up a more general reliance on trained engineers, quicker application of the results of a more intensified research, and closer contact between manufacturers of building materials, designers, constructors, and owners of structures. In the field of building materials, dimensional varieties, specifications, and nomenclature have been more generally standardized, and trade associations and technical institutions have carried on more research on properties and uses. National advertising has served to intensify competition. Economies through improved design and use of labor-saving equipment have been most notable in the case of roads and some other types of engineering construction where large quantities of materials are handled; these economies have been somewhat less conspicuous in the case of large buildings, and still less in the case of small houses There have been, however, notable advances in the design of buildings, both as to architectural quality, arrangement of space, and economical use of materials. Buildings are more completely and elaborately equipped, and more durable and permanent. Trade associations, professional groups, and research institutions have contributed much toward technical advances, and the movement for modernizing building codes in keeping with new developments has made distinct progress. The process of manufacture of building materials is being carried further along in the plant, so that there is less work to perform at the site. The time required for most types of construction has become much less—a tendency greatly stimulated during the war.

Recent national construction programs amounting to more than $7,000,000,000 annually are conservative in relation to national income and savings, if compared with prewar conditions.

Relatively more construction than formerly is now definitely planned with reference to long-time conditions. The large programs of public utilities, for example, have been carefully designed to provide economical service for the growing needs of the territories covered. Railway building during the last third of the nineteenth century, on the contrary, often was highly speculative, or involved duplication of facilities. City planning and zoning, and analyses by individual owners, have made possible better location of buildings and public works with relation to one another. Conscious efforts to prosecute new work with reference to available supplies of labor and materials have helped to reduce the intensity of seasonal and other temporary fluctuations.

The more even growth of population in recent years, owing to operation of the immigration acts, and the unusual decline in farm population, have affected the demand for urban housing.

The extension of residential areas in and about cities, made possible by the automobile and improved streets, and encouraged by the demand for outdoor recreation, has resulted in a remarkable suburban growth of detached houses. Construction of apartments, usually for adults, has increased.

Minimum standards of light, air, and sanitary facilities in new construction, and growing vacancies in districts where housing is the poorest, indicate improvement in housing standards.

There has been a marked lessening of labor disputes. The five-day week has been sought in various cities by various trades, and is now being tried out under agreements affecting many thousands of workers.

Group, intergroup, and community efforts to solve such problems as seasonal stabilization, improved documentation, better architectural design, standardization, simplification, and credit relations, have gained in scope and intensity during the period studied.

CHAPTER IV

TRANSPORTATION

PART I.—RAILWAYS

By William J. Cunningham

The recent reorganization of American railways and the improvement in rail transportation service have been characterized by an eminent authority as "probably the most outstanding industrial accomplishment since the war."[1]

In this review of economic changes in railways and their administration and public service since 1920, the significant developments in capital expenditures for betterments, financial organization, volume of traffic, motor vehicle competition, freight and passenger rates, labor conditions, operating efficiency, net income, valuation, consolidation, and quality of public service are discussed in turn.

I. CAPITAL EXPENDITURES

The large and continuing expenditure for additions and betterments to roadway, structures, terminal facilities, signaling, locomotives, and cars, is one outstanding feature in a review of railways since the war period. From 1920 to 1927, inclusive, the railways have made gross capital expenditures of almost six billion dollars. That sum has been divided about equally between (1) roadway and structures and (2) equipment—locomotives and cars. The additional investment has not created more route mileage, but has added to track mileage. The number of units of equipment has not been changed materially, but the capacity of the average unit and the aggregate capacity of all have been increased.

For nearly a decade prior to April, 1917, when the United States entered the World War, the diminishing net income of the railways had forced a curtailment in the former normal program of expenditures for enlargement and improvement of the railway plant and equipment. The common policy had been to keep facilities and their capacity reasonably ahead of the demands of steadily increasing traffic. That policy could not be maintained after 1910, except by relatively few companies. The financial condition of the carriers as a whole was serious, notably during the latter part of the five-year period between 1910 and 1915, and many roads were forced into receivership. This alarming situation was attributable mainly to the growing burden of advancing costs of material and supplies, higher wage rates, and the disinclination of the Interstate Commerce Commission to authorize rate increases. Besides, there was a slowing up in the normal growth in traffic so that the lower unit costs, usually possible with greater volume of business, could not be realized. The first effects of the World War, in the latter part of 1914 and throughout 1915, were to hold back business activity in general and to react unfavorably upon railway earning power. The net railway operating income of $805,000,000 for the fiscal year ended June 30, 1910, had shrunk to $679,000,000 in 1915.

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[1] Annual Report of Herbert Hoover, Secretary of Commerce, for the fiscal year 1926.

In 1916, the effects of orders for war materials from the Allies, and the feverish activity in the building and operation of plants engaged in the manufacture of such materials, were to stimulate business in general and to increase railway traffic. The net railway operating income jumped from $679,000,000 in the year ended June 30, 1915, to $1,058,000,000 in the calendar year 1916. From the point of view of net return upon railway investment, 1916, with a rate well over 6 per cent, was the best year the railways have had. The favorable results were possible because there was just enough unused capacity in facilities to take care of the heavier traffic without serious overload, so that the economic law of increasing returns had full play.

Had there been no further disturbance, it is possible that the better net income might have permitted the railways to resume the former normal program of betterments and enlargements, and their facilities and equipment might have been made equal to the needs of an even larger volume of traffic. But it was difficult to obtain capital funds. The opportunities in the industrial field were competitively much more attractive to investors. It was difficult also to obtain materials and labor when munition and other war supply plants could overbid the railways. Then when the United States entered the war, came mobilization and an extensive national program of construction of cantonments, ships, aircraft, and the enlargement of other war supply plants.

The railways made a commendable effort to meet the much heavier transportation demand by voluntarily unifying their operations and abandoning competition under the Railroads' War Board, but the obstacles were so great as to prevent continuation of early success. The further increase in traffic brought an overload on the carriers serving the Atlantic seaboard, and congestion ensued. The facilities and equipment were inadequate under the conditions of confusion in right of priority to preferred service; the carriers were unable to obtain funds on reasonable terms for vitally needed additional facilities or to refund obligations about to mature; the draft and demands of war-material production had left no labor supply; the railway employees, chafing under the growing spread between their wages and those paid to workers in other industries, demanded advances on threat of strike; and, finally, there was serious doubt as to whether the railways in their voluntary unification were not violating the Sherman Act. This combination of conditions, notably the serious traffic congestion, led President Wilson, as a war emergency measure, to take over the railways, effective January 1, 1918, to be operated for the Government by a Director General of Railroads.

The results of Federal control and operation of railways from January 1, 1918, to March 1, 1920, need not here be reviewed except to say that under complete unification, with unprecedented power in the hands of the Director General, the railways were effectively operated as a branch of the Government. Traffic congestion was relieved within a few months. The funds imperatively needed for facilities and equipment were supplied by the Government. Wages were advanced. Freight and passenger rates were increased. Nonessential traffic was regulated by the issuance of permits. In brief, the railways in 1918 produced a greater volume of transportation than in any previous year, and rail service was effectively co-ordinated with the war-time activities of the Army, Navy, and allied branches of Government service.

This summary of events prior to and during the war is here given to furnish a background for the review of railway policy in capital expenditures since the war. It is necessary to bear in mind that normal development had been retarded by low earning power immediately preceding the war, and that railways were underequipped for the overload of war traffic. It should be borne in mind also that the capital expenditures made during the period of Federal control were determined primarily by the peculiar demands of war traffic under unified control, and were influenced but slightly by considerations which would have governed the carriers themselves in furthering their purely corporate and competitive individual interests. In other words, the capital expenditures during the war-control period (aggregating $1,200,000,000) were determined mainly by the emergency needs of the hour rather than from the long-time point of view of the individual carrier and its requirements for traffic under normal competitive conditions. Most of this program was authorized and begun in 1918, but a large part was carried over into 1919. While, in greater part, the money was advanced by the Government from a revolving fund provided for that purpose by the Federal Control Act, the cost, with certain minor exceptions, was later assumed by the carriers. The details of capital expenditures, as reported by the Director General in 1920, are listed in Table 1.

The year 1920 was one of readjustment and rehabilitation of the carriers individually after the period of unified Federal control. It was a year also of heavy traffic, which, because of car shortages, was not moved without serious delays and inferior service. In an effort to

TABLE 1.—CAPITAL EXPENDITURES DURING FEDERAL CONTROL

Item	1918	1919	Two years
Roadway and track	$294,000,000	$247,000,000	$ 541,000,000
Improvements to existing equipment	19,000,000	21,000,000	40,000,000
New equipment purchased by railroads	161,000,000	64,000,000	225,000,000
New equipment purchased by United States Railroad Administration	118,000,000	239,000,000	357,000,000
Total 1918 and 1919	$592,000,000	$571,000,000	$1,163,000,000
Estimated expenditures in January and February, 1920	.	. .	37,000,000
Grand total			$1,200,000,000

improve facilities and equipment, substantial appropriations were made for additions and betterments. In that year, the gross capital expenditures amounted to $653,267,000.

In 1921 there was a marked decline in railway traffic and earnings, but the program of betterments was continued. The gross capital expenditures in that year aggregated $557,035,000, and in 1922 they were $429,273,000.

These expenditures of the three years 1920 to 1922, inclusive, while substantial, were far exceeded by the expenditures beginning with 1923, when the carriers, acting together through the Association of Railway Executives, in an effort to gain public confidence and goodwill, pledged themselves to "a program to provide adequate transportation." With a larger volume of traffic in sight, and disturbed by the fear of recurrent interruptions by car shortage or other transportation difficulty, the carriers set out to improve their individual performances in technical efficiency. To make that possible, the appropriations for betterments were more liberal and comprehensive.

Through the American Railway Association, the railways from time to time since 1923 have published certain data, compiled by the Bureau of Railway Economics, showing the annual capital expenditures of Class I railways.[2] The figures for the years 1920 to 1927, inclusive, are given in Table 2. The amounts in all cases are greater than those reported in the annual reports of the Interstate Commerce Commission, as the figures of the Bureau of Railway Economics are the gross amounts without deduction for property retired and other similar adjustments. In Table 2 are included also the net increases in the investment account of Class I roads and their operating subsidiaries, as adjusted by the Interstate Commerce Commission for retirements and other factors.

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[2] The Interstate Commerce Commission classification places in Class I carriers whose operating revenues are above $1,000,000 per year. Class II carriers are those whose annual operating revenues are $100,000 to $1,000,000. Class III embraces the remainder, with operating revenues less than $100,000. The route mileage of the three classes in per cent of total in 1926 was: Class I, 90.63 per cent; Class II, 6 per cent; Class III, 2.32 per cent. The remaining 1.05 per cent was made up of a few small railways not reporting to the Interstate Commerce Commission. In operating revenues Class I roads earned 97.30 per cent of the total, with Classes II and III, 1.49 per cent and .07 per cent, respectively.

TABLE 2.—CAPITAL EXPENDITURES AND NET ADDITIONS TO INVESTMENT IN ROAD AND EQUIPMENT, CLASS I RAILWAYS AND THEIR OPERATING SUBSIDIARIES, 1920 TO 1927, INCLUSIVE

Year ended December 31	Gross capital expenditures (Bureau of Railway Economics)	Net additions to road and equipment (Interstate Commerce Commission)
1920	$ 653,267,000	$ 551,459,000
1921	557,035,000	442,043,000
1922	429,273,000	362,090,000
1923	1,059,149,000	808,208,000
1924	874,743,000	714,251,000
1925	748,191,000	579,975,000
1926	885,086,000	652,419,000
1927	771,552,000	698,069,000
Total 8 years	$5,978,296,000	$4,808,514,000
Average per year	747,287,000	601,064,000

The first column in Table 2 represents the amount of cash expended for extensions, additions, and betterments; the second column gives the net amounts added to the property investment account. The difference is mainly in charges to operating expenses or profit and loss, with corresponding credits to the investment account for property retired or abandoned in connection with such work. From the point of view of gross cash expenditures, the improvements made to plant and equipment in the eight years 1919 to 1927, inclusive, have averaged almost three-quarters of a billion per year. The net average yearly addition to the investment account was $601,064,000, or an increase of nearly 3 per cent per year.

It is interesting to note that, while for the entire period the expenditures for roadway and track and those for equipment were almost equal in amount, the percentage devoted to equipment has been declining. In 1920 it was 60 per cent, but in 1925 and 1926 it was 37 per cent and 36 per cent, respectively.

In Table 3 are shown the details of net charges to investment in road and equipment and the percentages by the three general accounts.

As supplemental information, Table 4, based on information compiled by the Bureau of Railway Economics, is added. The table shows the gross capital expenditures, 1922 to 1927, inclusive, subdivided between classes of equipment and items in roadway and structures. Under

TABLE 3.—NET CHARGES TO INVESTMENT IN ROAD AND EQUIPMENT, BY GENERAL ACCOUNTS, CLASS I RAILWAYS AND THEIR OPERATING SUBSIDIARIES, 1920 TO 1927, INCLUSIVE

Year	Road	Equipment	General	Total
1920:				
Total	$ 213,793,000	$ 333,422,000	$ 4,244,000	$ 551,459,000
Per cent	39	60	[a]	100
1921:				
Total	186,821,000	251,459,000	3,763,000	442,043,000
Per cent	42	57	[a]	100
1922:				
Total	219,597,000	139,444,000	3,049,000	362,090,000
Per cent	60	39	[a]	100
1923:				
Total	336,606,000	466,278,000	5,324,000	808,208,000
Per cent	42	58	[a]	100
1924:				
Total	346,330,000	361,022,000	6,899,000	714,251,000
Per cent	48	51	[a]	100
1925:				
Total	360,526,000	216,009,000	3,440,000	579,975,000
Per cent	62	37	[a]	100
1926:				
Total	416,371,000	232,694,000	3,354,000	652,419,000
Per cent	64	36	[a]	100
1927:				
Total	522,482,000	163,614,000	11,973,000	698,069,000
Per cent	75	23	2	100
Grand total	$2,602,526,000	$2,163,942,000	$42,046,000	$4,808,514,000
Per cent	54	45	1	100

[a] Less than 1 per cent.

TABLE 4.—GROSS CAPITAL EXPENDITURES, CLASS I RAILWAYS AND THEIR OPERATING SUBSIDIARIES, 1922 TO 1927, INCLUSIVE

Item	Amount	Per cent
Locomotives	$597,810,000	12.3
Freight train cars	1,449,695,000	30.4
Passenger	264,375,000	5.6
Other equipment	107,698,000	2.3
Total equipment	2,419,578,000	50.6
Additional track and track material	727,487,000	15.2
Heavier rail	195,656,000	4.1
Shops and enginehouses	218,146,000	4.6
All other improvements	1,207,128,000	25.5
Total road and structures	2,348,417,000	49.4
Grand Total	$4,767,995,000	100.0

equipment it may be noted that freight cars took 60 per cent of gross expenditures for equipment or 30 per cent of all gross capital expenditures.

Improvements in Roadway and Structures.—The effects of the capital expenditures since the war may now be viewed from the angle of changes in physical units, in so far as they may be quantitatively measured. In road and structures, suitable units are available in but few items, but in equipment fairly complete information may be had.

Little change in the total route mileage—that is, the miles of roadway without regard to the number of tracks—has occurred since 1913. The operated route miles of all railways in that year were 253,470. In 1916 they were 259,211. Since then, the additions have been almost offset by mileage abandoned. The total operated route miles in 1927 were 259,639.

When the total track miles are considered (instead of route miles or miles of first track), the changes are more significant. The total track miles in 1913 were 379,508. Since then, there has been a steady net increase, notwithstanding losses by abandonment. The total in 1927 was 424,737, an increase since 1913 of 11.9 per cent. The changes since the war are shown in Table 5.

TABLE 5.—MILES OF ROAD AND TRACK OPERATED, ALL RAILWAYS, 1920 TO 1927, INCLUSIVE

Year	First track	Other main tracks	Yards and sidings	Total
1920	259,941	36,894	109,744	406,579
1921	258,362	37,614	111,555	407,531
1922	257,425	37,888	114,046	409,359
1923	258,084	38,697	116,212	412,993
1924	258,238	39,915	116,874	415,026
1925	258,631	40,962	118,361	417,954
1926	258,815	41,686	120,840	421,341
1927	259,639	42,071	123,027	424,737
Per cent increase 1927 over 1920	[a]0.1	14.0	12.1	4.4

[a] Decrease.

The miles of first track in 1927 were practically the same as in 1920. The greatest gain in trackage had been in second and other multiple running tracks, but a similar increase, larger in absolute amount but somewhat smaller relatively, is noted in miles of yard tracks and sidings. These figures indicate that the railway route miles are now fairly adequate for transportation needs, especially in view of highway competition, and that the network of rail lines is not likely to expand in the future as it has in the past. But it is likely that there will be continuous need for the enlargement of capacity of existing lines by the construction of additional running tracks and sidings, and the enlargement and improvement of terminals. The limiting point in the traffic-carrying capacity of the typical railway has been, and still is, in its terminals. A large part of the recent expenditures for capital improvements has been devoted to terminal improvements.

The capacity of a railway may ordinarily be increased substantially by the installation of modern automatic signals. They permit trains to run under closer headway, reduce the number of train stops, and otherwise cut down road delays which have been from 25 per cent to 33 per cent of total time between terminals. The extent of such installations is indicated by the changes in the mileage equipped with automatic signals. At the close of 1906, the railway route miles so equipped were 6,535. In 1911, they were 19,737; in 1916, 31,167; in 1921, 37,196; and in 1927 they were 50,953, an increase of 37 per cent over 1921.[3] This substantial increase in signaling, intended to "save seconds safely," has important bearing upon the gains in operating efficiency.

The data from which it is possible to compute definite units reflecting changes in such physical elements as weight of rail, number of ties, depth of ballast, and capacity of bridges are meager. With the greater strains upon track, roadway, and structures by heavier locomotives and cars, the tendency is to use heavier rail sections, to increase the number of ties per rail length, to use ties chemically treated to resist decay, to apply heavier tie plates, angle bars, and rail fastenings, to use better ballast and increase its depth, and to replace light bridges and culverts by new construction with greater strength and longer life.

The average weight of rail in all main tracks of Class I roads on December 31, 1921, was 82.89 pounds per yard. On December 31, 1927, it was 88.09 pounds. According to the American Iron and Steel Institute, the total production of steel rail of 100-pound section or heavier, in 1914, was but 27 per cent of the total; in 1921 it was 39 per cent, and in 1927 it was 69 per cent. Nearly one-quarter of the total tons rolled in 1927 were of 120-pound section or heavier. Current installations on several of the carriers are in sections of 135-pound.

The common use of treated ties, notably during the past six years, has had the effect, by prolonging the life of ties, of reducing the number required annually for renewals. Since 1922, the total number of new ties placed in previously constructed tracks of Class I roads has declined, notwithstanding the increase in trackage. The renewals in 1922 were 86,642,000; in 1923, 84,435,000; in 1924, 83,073,000; in 1925, 82,717,000; in 1926, 80,746,000; and in 1927, 78,340,000. While the total renewals have been less, the number of treated ties has been increasing—40,630,000 in 1922 and 57,083,000 in 1927. The treated ties in 1922 were 47 per cent of the total, and in 1927, 73 per cent.

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[3] Summarized from data submitted by 169 railways in answer to Interstate Commerce Commission questionnaire of July 22, 1927.

Locomotives and Cars.—When we turn to an examination of the equipment inventory in 1927 and the comparison with 1920, the striking fact is that there has been but a slight increase in the number of freight cars and an actual decrease in the number of locomotives, although the ton-mile product in 1927 was greater. With practically the same number of all passenger train cars, a decrease is shown in passenger carrying cars. The explanation is that the capacity of the average locomotive[4] and freight car has increased, and, because of better facilities and improved operating technique, the equipment is being used more effectively. Hence, the railways, with practically the same number of freight cars in 1927 as in 1920, were able to handle substantially more tonnage and to provide service free from congestion or undue delay. The decline in passenger traffic accounts for the smaller number of passenger cars.

The number of steam locomotives in all classes of service on Class I roads in 1920 was 64,368. In 1927 it was but 60,868. The average tractive capacity, however, in 1920 was 36,365 pounds, while in 1927 it was 42,803 pounds. Thus the aggregate capacity of the smaller number of locomotives in 1927 was actually about 11 per cent greater than the aggregate capacity of the larger number in 1920. The improvement in locomotive design, moreover, has not been confined to the increase in tractive capacity. There is now a greater use of economizing devices, such as high-pressure boilers, superheaters, feed-water heaters, limited cut-off, boosters, and other improvements in design.

The number of freight cars owned by Class I railways in 1920 was 2,340,761, and the average capacity per car was 42.4 tons. In 1927, the total of railway-owned cars was 2,324,101 and the average capacity per car was 45.6 tons. Thus, while in number there has been little change, the aggregate capacity, because of retirement of old cars of low capacity, has been increased 8 per cent. Private line freight cars used in railroad service on a rental basis are not included in the totals. Of these, there were 203,372 in 1923 and 288,446 in 1927.

The number of passenger service cars of Class I roads in 1920 was 53,501. In 1927 it was 53,822. There was a slight increase in baggage, mail, and express cars, but the number of coaches and combination cars decreased from 36,814 in 1920 to 32,023 in 1927. Pullman cars, of which there were 7,764 in 1922 and 9,017 in 1927, are not included in the total. Elsewhere it is noted that the shrinkage in railway-borne passengers is mainly in local service. The cars released by taking off local trains are mainly of old type, and the retirements have not been offset entirely by acquisition of new equipment for through trains.[5] The details of equipment changes are listed in Table 6.

[4] See Improvement in Power Plant, Chap. II, Industry, Part 2, pp. 119 et seq.; Chap. IV, Transportation, Part 2, p. 312.

[5] See Obsolescence, Chap. II, Industry, Part 2, pp. 129, 139; Chap. III, Construction, p. 226; Chap. V, Marketing, p. 330.

TABLE 6.—EQUIPMENT OF CLASS I RAILWAYS, 1920 TO 1927, INCLUSIVE

Year	Steam locomotives[a]			Freight train cars[b]			Passenger train cars[c]	
	Number	Total tractive capacity (thousand pounds)	Average tractive capacity (pounds)	Number	Total capacity (thousand tons)	Average capacity (tons)	Passenger carrying cars	Total
1920	64,368	2,340,761	36,365	2,322,025	98,343	42.4	36,814	53,501
1921	64,585	2,385,470	36,935	2,315,595	98,504	42.5	34,079	54,331
1922	64,140	2,401,452	37,441	2,293,389	98,847	43.1	33,997	54,354
1923	64,939	2,544,115	39,177	2,315,609	101,318	43.8	33,990	54,718
1924	65,006	2,593,178	39,891	2,348,722	104,149	44.3	33,880	55,040
1925	63,612	2,586,868	40,666	2,357,221	105,570	44.8	33,131	54,622
1926	63,342	2,611,238	41,886	2,348,643	105,953	45.1	32,977	54,773
1927	60,868	2,605,347	42,803	2,324,101	105,819	45.6	32,023	53,804

[a] In 1920 there were 153 electric locomotives, in 1927 there were 449

[b] Private line freight cars not included.

[c] Pullman cars not included.

The greater use of steel in car construction is noteworthy. In 1920, the number of all-steel freight cars was 630,150. Of steel underframe with wood bodies there were 886,296. Of the total cars, 27 per cent were all-steel and 38 per cent had steel underframes, or 65 per cent in both classes. In 1927, there were 799,820 cars of all-steel and 1,086,982 with steel underframes—34 per cent of the total in all-steel, 47 per cent with steel underframes, or 81 per cent in all. In 1920, there were 15,111 passenger train cars of all-steel, or 28 per cent of the total, and with steel underframes there were 6,573, or 12 per cent of the total, making 40 per cent of steel construction. In 1927, this percentage had grown to 65 per cent—25,342, or 47 per cent, of all steel and 9,677, or 17 per cent, with steel underframes.

II. CHANGES IN FINANCIAL ORGANIZATION

Compared with the recent substantial additions to capital investment, the increase in railway capital obligations is relatively small. In Tables 7 and 8 are shown, by years beginning with 1920, the total investment of all railways in road and equipment and the total capitalization in stocks and bonds.

Subject to qualifications hereinafter noted, three significant points stand out in a comparison of the figures in the two tables and their relation to gross capital expenditures.[6]

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[6] The difference between the gross capital expenditures and the net additions to the investment account is explained by the credits to investment and corresponding charges to operating expenses or to surplus for property retired and replaced or abandoned. Operating expenses or surplus must be charged and the investment account credited with the original cost of property consumed in operation, and the

1. The aggregate gross expenditures for extensions, additions, and betterments during the years 1920 to 1927, inclusive, (Table 2) were $5,978,296,000.

2. The net increase in the account "Investment in Road and Equipment" during the same period (Table 7) was $4,604,551,000.

3. The net increase in railway capitalization (stocks and funded debt) during the same period (Table 8) was $1,142,761,000.

From the fact that additional securities amounting to $1,142,761,000 were issued against an additional investment of $4,604,551,000, it is evident that the railways have been financing the greater part of improvement work out of current income or surplus.

Prior to July 1, 1907, there was no classification of expenditures for road and equipment, and the accounting methods of the carriers were not uniform. The policy of many prosperous carriers had been to charge substantial parts of improvement costs to operating expenses, thereby understating the investment account and creating hidden reserves. Many of the weak carriers, on the other hand, went to the opposite extreme in charging to capital amounts which should have been charged to current operation, thereby bringing about an overstatement of investment with a corresponding overstatement of current net income. In defense of the prosperous roads, it may be said that this "ploughing in" process was on the side of conservatism, even though disguised by an understatement of net profits, but, with respect to the opposite policy of the weak carriers, there is no defense except that of financial expediency when true accounting might have precipitated financial trouble by calling attention to inadequate earning power. In either case, the carrier was not bound by specific instructions from the Commission, as its earlier efforts to bring about uniformity had not been extended to the investment account. While the carriers were required to report annually the details of their balance sheet and surplus accounts, each was left free to follow its own accounting policy in the matter of capital expenditures. Hence the balance sheet account "Cost of Road and Equipment," prior to 1907, was not uniformly kept. It is probable that the undercharges to that account, by reason of capital expenditures absorbed in operating expenses, were greater than the overcharges improperly made to hold down operating expenses.

Since 1907, the carriers have been governed by definite instructions from the Commission, and the additions to the investment account in the 20 years of uniformity in accounting have been so large in the aggregate as to reduce the questionable base of 1907 to but one-half of the

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investment account charged with the original cost of the replacements or additions. The net addition to the investment account may be capitalized in full either at the time the expenditures are made or later, but conservatism demands that securities should not be issued against the whole amount.

present total. On June 30, 1907, the book value of road and equipment, all carriers, was reported as $13,030,344,328, and on December 31, 1927, it was $24,453,870,938.

Inasmuch as we are concerned here only with recent changes, the figures in Table 7 are confined to the years since the war. The lack of uniformity in accounting prior to 1907 does not affect the present comparison, as the additions since 1907 have been accounted for under uniform practice.

TABLE 7.—INVESTMENT IN ROAD AND EQUIPMENT, ALL RAILWAYS, DECEMBER 31, 1920 TO 1927

Year	Amount	Year	Amount
1920	$19,849,319,946	1924	$22,182,267,385
1921	20,329,223,603	1925	23,230,915,985
1922	20,580,168,269	1926	23,880,740,146
1923	21,372,858,161	1927	24,453,870,938

TABLE 8.—CAPITALIZATION OF ALL RAILWAYS, DECEMBER 31, 1920 TO 1927

(In millions of dollars)

Year	Common stock outstanding	Preferred stock outstanding	Funded debt outstanding	Total capital outstanding	Stocks and bonds owned by railways	Net capitalization
1920	7,216	1,898	12,778	21,891	4,897	16,994
1921	7,275	1,800	13,216	22,292	5,209	17,083
1922	7,307	1,834	13,149	22,290	5,010	17,280
1923	7,398	1,852	13,589	22,839	5,028	17,810
1924	7,539	1,935	14,162	23,636	5,435	18,202
1925	7,602	1,937	14,105	23,644	5,454	18,191
1926	7,560	1,924	14,192	23,677	5,443	18,234
1927	7,683	1,980	13,952	23,614	5,477	18,137

Attention has been called to the relatively large part of additional net investment financed from income and surplus. That conservative policy of financing, however, was not altogether one of choice. As a matter of fact, the railways, because of unsatisfactory net earnings just before and immediately after the war, were unable, with a few notable exceptions, to sell stock, and their bonds in the early postwar period could be sold only at high rates of interest or at substantial discount.[7]

[7] Throughout the period 1920 to 1927, inclusive, only eight companies—Illinois Central, New York Central, Chesapeake & Ohio, Southern, New York, Chicago & St. Louis, Baltimore & Ohio, Atlantic Coast Line, and St. Louis San Francisco—sold any substantial amounts of stock to the public for cash. The only other sales for cash were in connection with reorganization or were for intercorporate purposes. In 1920, the Pennsylvania Railroad found it necessary to offer 7 per cent in order to sell a 10-year bond for refunding purposes. In refunding their joint issue of collateral trust bonds, based on Chicago, Burlington & Quincy stock, the Great Northern and

TABLE 9.—CONDENSED BALANCE SHEET, CLASS I RAILWAYS EXCLUSIVE OF THEIR NONOPERATING SUBSIDIARIES, DECEMBER 31, 1920 AND 1927

Item	1920	1927
ASSETS	*Thousands of dollars*	*Thousands of dollars*
Investments:		
Investment in road and equipment	15,665,749	18,522,613
Improvements on leased railway property	331,075	454,041
Miscellaneous physical property	232,584	159,094
Investments in affiliated companies	4,032,349	4,710,083
Other investments	708,686	905,782
Total investments	20,970,443	24,751,613
Current assets:		
Cash	369,422	495,846
Miscellaneous accounts receivable	793,472	213,184
Materials and supplies	755,563	523,651
Special deposits and other current assets	599,543	483,309
Total current assets	2,518,000	1,715,990
Deferred assets, total	1,898,417	194,998
Unadjusted debits, total	874,983	305,984
Grand total	26,261,843	26,968,585
LIABILITIES		
Stock:		
Capital stock	7,209,735	7,831,282
Stock liability for conversion	35,345	1,510
Premium on capital stock	42,124	48,094
Total stock	7,287,204	7,880,886
Grants in aid of construction	2,944	7,139
Long-term debt		
Funded debt unmatured	9,690,092	10,511,573
Receivers' certificates	14,468	4,070
Non-negotiable debt to affiliated companies	310,682	425,937
Total long-term debt	10,015,242	10,941,580
Current liabilities:		
Loans and bills payable	291,952	64,499
Miscellaneous accounts payable	179,608	110,711
Other current liabilities	1,410,277	1,136,090
Total current liabilities	1,881,837	1,311,300
Deferred liabilities	2,305,308	123,447
Unadjusted credits:		
Accrued depreciation	995,938	1,753,903
Other unadjusted credits	832,535	689,288
Total unadjusted credits	1,828,473	2,443,191
Corporate surplus:		
Additions to property through income and surplus	818,245	859,192
Funded debt retired through income and surplus	84,580	82,612
Sinking fund reserves	51,941	40,030
Miscellaneous fund reserves	36,757	55,463
Appropriated surplus not specifically invested	101,876	60,104
Total appropriated surplus	1,093,399	1,097,401
Profit and loss surplus—balance	1,847,436	3,163,641
Total corporate surplus	2,940,835	4,261,042
Grand total	26,261,843	26,968,585

Northern Pacific in 1921 had to offer the new issue at 6½ per cent and to sell at a discount. The prevailing rate during that time and for a year or two later was from 6 to 5½ per cent for well-secured mortgage bonds. The average rate of interest (based upon par without taking into account discount) upon all new bonds issued in 1922 was 5.53 per cent. The average has since been lower—5.29 per cent in 1923, 5.05 per cent in 1924, 5.16 per cent in 1925, 4 88 per cent in 1926, and 4.84 per cent in 1927. These averages, reported by the Interstate Commerce Commission, would be more significant if the yield were based upon the amount actually paid rather than upon par, but they indicate the tendency toward a lower interest rate on railroad funded debt.

A general view of the financial structure of Class I railways in 1920 and 1927 is afforded by Table 9, in which are condensed the significant items of the balance sheets of Class I railways as of December 31, 1920 and 1927. These figures are for the owned properties of Class I railways and therefore do not include their nonoperating subsidiaries. The tabulation is not complete but is intended merely for the purpose of comparison between the two periods.

The impracticability, except in the few exceptional cases, of carriers financing the capital improvements of recent years by the sale of stock has led to an unhealthy tendency to increase the proportion which the funded debt bears to total capitalization. While no hard and fast rule can be applied without qualification, financial prudence dictates that the stake of the stockholders in the enterprise which they control should be little, if any, less than the amount which they borrow.*

During the decade of 1890–1900, the ratio of funded debt to total capitalization of all railways ranged between 50 and 53 per cent. In the following decade, it began at 49 per cent and ended at 56 per cent. Since 1910, it has steadily increased, and, since 1923, has stood between 59 and 60 per cent. The figures in Table 9, for Class I railways only, show that the ratio was 57.9 per cent in 1920 and 58.1 per cent in 1927. Including roads of Classes II and III, the ratio in 1927 was 59 per cent.

III. CHANGES IN VOLUME OF TRAFFIC

The two principal measures of railway traffic volume are revenue ton-miles and revenue passenger-miles. These units take account not only of the number of tons and passengers, but also of the distance carried in each case.

Transportation by rail in 1920 was one of record-breaking proportions. In tons, ton-miles, passengers, and passenger-miles, the volume was substantially greater than in 1916, the previous year of high record. Business in general was unusually active, in contrast to the inactivity of 1919, and the civilian passenger traffic was augmented by the processes of demobilization of military forces.

From the point of view of freight service, there have been three relatively poor years since 1920. The revenue ton-miles of 1921, 1922, and 1924 were less than those of 1920, but with a larger volume of business in the other postwar years the trend of freight traffic has been upward. The year 1926 now holds the record—443.7 billion revenue ton-miles for

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* This is clearly an expression of opinion. It may be argued that investments in public utilities should be mainly nonspeculative and should have a limited return, that bonds with their fixed and relatively low return are less speculative than stocks, and that, if the Transportation Act is successfully administered, the railway net income will, on the whole, be adequate to permit regularity of interest payment on a large percentage of fixed obligations in the cases of those roads which might in any case market stock.—Note by George Soule, Director of the National Bureau.

Class I railways. The comparable figure in 1927 was 428.6 billions; in 1925 it was 413.8 billions; and in 1920 it was 410.3 billions.

In contrast to the growth in freight tonnage, the passenger-miles have fallen off seriously. The total of 1920—46.8 billion passenger-miles on Class I railways—is likely to stand for a long time as the high record. Since then, with one exception, every successive year has shown a substantial decline both in passengers carried and in passenger-miles. The passenger-miles on Class I railways in 1927 were 33.6 billions, a decrease from 1920 of 13.2 billions, or 28 per cent. This decline will be discussed in the next section of this chapter.

The details of both freight and passenger transportation for Class I railways, 1920 to 1927, are shown in Table 10.

TABLE 10.—FREIGHT AND PASSENGER SERVICE, CLASS I RAILWAYS, 1920 TO 1927, INCLUSIVE

Year	Freight service			Passenger service		
	Revenue tons carried	Revenue ton-miles	Average haul	Passengers carried	Passenger-miles	Average journey
	Millions	*Millions*	*Miles*	*Millions*	*Millions*	*Miles*
1920	2,260	410,306	181.5	1,235	46,849	37.9
1921	1,691	306,840	181.5	1,035	37,313	36.0
1922	1,841	339,285	184.3	967	35,470	36.7
1923	2,334	412,727	176.9	987	37,957	38.5
1924	2,172	388,415	178.8	933	36,091	38.7
1925	2,304	413,814	179.6	888	35,950	40.5
1926	2,465	443,746	180.0	862	35,478	41.1
1927	2,362	428,621	181.5	830	33,648	40.6

An examination of commodity statistics in Table 11 reveals, with one exception, no notable changes in tonnage by groups or in the percentage which each group bore to the grand total, 1920 to 1927. The exception is noted in products of mines which, because of labor troublee at the coal mines in 1921 and 1922, moved in smaller volume. The coas tonnage is such a large part of the total that fluctuations in that single item may distort the percentage relationships of other commodity groups to total. For example, in 1921, the tonnage of products of agriculturl was but 1 per cent more than in 1920, yet its proportion of total tone jumped from 9.76 per cent to 13.17 per cent, because the tonnage of mins products fell off so sharply with losses in all other groups. The volume of tonnage of agricultural products has been remarkably uniform throughout the entire period, the upper and lower extremes being 230.9 million tons in 1924 and 215.1 million tons in 1925. The same comment may be applied to animal products and forest products, although the fluctuations are greater than those in agricultural products. A much greater range is apparent in manufactured products. These moved upward or downward in harmony with fluctuations in the tonnage of mine products. The volume of less-than-carload tonnage shows a downward tendency, reflecting the effect of motor truck competition.

TABLE 11.—REVENUE FREIGHT CARRIED, BY CLASSES OF COMMODITIES, CLASS I RAILWAYS, 1920 TO 1927

Year	Products of agriculture	Animals and products	Products of mines	Products of forests	Manufactures and miscellaneous	Less than carload	Total
	Total tons carried (in millions)						
1920	220.0	44.9	1,209.1	195.6	494.6	89.9	2,260.0
1921	222.7	41.8	878.2	148.0	333.0	67.0	1,690.8
1922	220.7	44.8	912.4	171.2	421.8	69.9	1,840.9
1923	220.5	48.9	1,250.2	222.6	517.8	73.6	2,333.6
1924	230.9	48.5	1,114.6	209.4	500.3	68.1	2,171.7
1925	215.1	46.3	1,212.0	210.1	552.5	68.2	2,304.3
1926	223.9	47.0	1,341.6	204.8	579.8	68.2	2,465.4
1927	221.0	46.7	1,271.7	192.7	564.1	65.8	2,361.9
	Per cent of total tons						
1920	9.76	1.99	53.64	8.68	21.94	3.99	100
1921	13.17	2.47	51.94	8.76	19.69	3.97	100
1922	11.99	2.44	49.56	9.30	22.91	3.80	100
1923	9.45	2.09	53.58	9.54	22.19	3.15	100
1924	10.63	2.23	51.33	9.64	23.04	3.13	100
1925	9.33	2.01	52.60	9.12	23.98	2.96	100
1926	9.08	1.91	54.42	8.30	23.52	2.77	100
1927	9.36	1.98	53.84	8.16	23.88	2.78	100

Another measure of railway freight traffic is available in the statistics of loaded cars, but the unit "cars loaded" is not as comprehensive as ton-miles since the former is not weighted for differences in carload weights or lengths of haul. The carloadings per week by years, since 1920, were as shown in the following statement:

1920	868,000
1921	756,000
1922	831,000
1923	958,000
1924	933,000
1925	985,000
1926	1,021,000
1927	995,000
First 11 months of 1927	1,006,000
First 11 months of 1928	1,001,000

A comparison of the carloadings and the ton-miles indicates that the fluctuations do not correspond in degree. In 1927, the excess of ton-miles over 1920 was 4.5 per cent, while the excess of cars loaded was 14.6 per cent. The difference is attributable in large measure to a lighter carload in 1927, but it is possible also that the carload statistics are not as carefully compiled as are the ton-miles. The discrepancy is not as great in later years. The per cent of decrease in ton-miles, 1927 under 1926, was 3.4 per cent, and the decrease in loaded cars was 2.5 per cent.

The average length of the haul (per railway) shows little change in freight service, but the average journey per passenger (per railway) shows an increase. This is owing to the loss of local passengers to the highway and to a slight increase in the number of long-distance passengers. These averages are partially deceptive in that interline tons and passengers (those which in a given movement are handled by more than one railroad) are counted once by each railroad and are thus duplicated in the totals. A better index of the freight haul is found by dividing the total ton-miles by the tons *originated*, thus giving the average haul per ton on the railways of the United States considered as one system. In 1920, the average haul per ton on that basis for all railways was 303.5 miles; in 1921 it was 304.11 miles; and in 1927, it was 314.75 miles. For the passenger service no such basis is available as no distinction is made in the statistics between originated and total passengers carried.

In view of the steady decline in the total passengers carried by rail, it is of interest to note that the number carried in Pullman cars (included in the railway total) has had an upward tendency. The number of Pullman car passengers in 1921 was 31,225,324, or 3 per cent of the total passengers carried by rail. By 1926, the number had grown to 36,073,211, or 4.2 per cent of total. In 1927, it had dropped to 35,197,178, but, because the loss in total passengers had been relatively greater, the Pullman percentage of the total remained at 4.2 per cent.

The changes in relative proportions of Pullman, commutation, and day-coach passengers (other than commutation) are more striking when stated in terms of revenue. In 1921, the Pullman passengers contributed 31.1 per cent of the total passenger revenue; in 1927, their contribution was 45.3 per cent, with a corresponding decline in total day-coach revenues from 68.9 per cent to 54.7 per cent. If, however, the commutation passenger revenue is segregated, the loss in day-coach passenger revenue other than commutation is much more impressive. Commutation passenger statistics are not available prior to 1922. In that year, the commutation revenue was 6.3 per cent of the total, and in 1927 it was 7.6 per cent. In the meantime, the day-coach passenger revenue (exclusive of commutation) declined from 59.9 per cent to 47.1 per cent.[8]

[8] These percentages are taken from a study made by Samuel O. Dunn, editor, *Railway Age*, and used by him editorially in the issue of March 19, 1927.

IV. EFFECT OF MOTOR VEHICLE COMPETITION

The passenger automobile as a modern agency of transportation is about twenty-five years old. The motor truck and the motor coach are even younger. Yet in many respects the automotive industry, in its quarter-century of development, has outstripped the railways, now a century old. The public investment in motor vehicles and hard-surfaced highways now exceeds the public investments in railways and their equipment. The number of employees in the automotive industry and highway transportation is more than those engaged in railway service. Motor vehicles now rank first in value of annual products and third in value of exported goods.

The effects of the private automobile and the motor coach on railway passenger traffic, and of the motor truck on railway freight traffic, are difficult to measure accurately. It is impossible to determine how many passenger-miles made by private motor vehicles are due solely to the desire to ride for pleasure, and how many passenger-miles are substitutes for railway transportation. To a large extent the passenger traffic by highway is not competitive with railways. It is created by the automobile itself, and would not be produced by railways if the automobile were not available. Passenger traffic by motor coach, however, is highly competitive with the electric and steam railways. The motor truck, almost entirely displacing the horse-drawn vehicles in urban communities, has widened the zone of local trucking and is taking from railways a substantial part of short-haul traffic in small shipments. In practically every city there are organizations of common carriers by motor truck. Then there are the contract truckers who serve only one or a limited number of customers under contract, and finally there are the trucks owned and operated by the individual industries for their own service exclusively.

The steady decline in railway passenger traffic since 1920 (Table 11) is evidence that the competition of motor vehicles is severe. The automobile is being used more and more on relatively short trips, both for business and pleasure, that formerly were made by rail. The public has recently shown a decided preference for the motor coach over the steam railway coach and the trolley car.

The railway loss has not been in the long-distance passengers. The Pullman car statistics support the statement that railway long-distance passenger traffic continues to grow slowly. It is probable, however, that the growth would have been much greater if the automobile and motor coach had not been developed.

Nor is the railway loss in suburban traffic. The number of commutation passengers has been increasing steadily—about 3 per cent per year since 1921. The railway loss is confined almost entirely to the traffic on local trains between adjacent cities or on secondary or branch lines. Such losses are serious, as the local passenger trains ordinarily have been poor earners, if not unremunerative, and the lighter loads have increased the number of trains with gross earnings less than the actual "out of pocket" expenses. This has brought about curtailment of train service or abandonment of branch lines, when such action is permitted by the regulatory authorities, and the effect of poorer railway service has been to stimulate the transfer of passengers to the highway.

The railway managers are concerned about the heavy losses in passenger traffic and the further competitive possibilities. To meet the new form of competition, many railways, besides improving their through train service, have organized motor coach companies as subsidiaries, and are recapturing a part of the lost traffic by catering to the public preference for rubber tires over steel. Motor coach lines are being operated by railways as substitutes for branch line steam trains, as auxiliaries to rail service, and even in the duplication of rail service. The railways, either directly or through subsidiaries, early in 1928 operated about 1,046 motor coaches over 10,519 route miles, and the service is expanding. The importance of this new railway activity is shown by the fact that the American Railway Association has recently created a new organization known as the Motor Transport Division of that association.

The competition of motor trucks in freight service is not so alarming from the railway point of view. The potentialities are not as great as in passenger service. A reasonable estimate of the transportation production of all motor trucks on the highways outside of cities is that they produce a total ton-mileage equivalent to less than 3 per cent of the actual ton-miles produced by railways. In mass movements over long distances the railway is supreme. To haul as much revenue freight as is carried by the average freight train with a crew of five or six men would require at least 140 fully loaded 5-ton trucks, with at least that number of operators, and with a total fuel cost of over $5 per mile in contrast to the railroad fuel cost of about 50 cents per mile. The trucks cannot compete successfully, except in the narrowly limited field of small short-haul shipments of relatively high value, or when the combination of pick-up, road haul, and final delivery service by truck saves time and minimizes damage or loss by theft. The zone, within which motor trucks can economically compete with railways for the transportation of selected commodities, varies with local conditions, but in a typical case the limit is from 30 to 50 miles, with a wider range under conditions favorable to the truck and for a small number of commodities.

The railway commodity statistics (Table 11) show that the volume of less-than-carload freight is declining. A part of the loss may be attributed to motor truck competition. Studies made by the highway authorities of several states indicate that the volume of truck-borne tonnage which might move by rail is substantial and is increasing. Relatively, however, the freight which the motor truck is taking from the rails is small and, what is more important, it is the kind of traffic which the railways can give up with little, if any, net loss. The small, short-haul shipments, while yielding a high gross revenue per ton-mile, are carried at exceedingly high ton-mile cost, and the net revenue is relatively low. This kind of traffic is burdensome in its demands upon terminals and freight cars, and usually is moved in way-freights, the poorest paying of freight trains. Confronted with the continuing necessity for enlarging terminals and increasing the productivity of equipment, the railways may regard with equanimity the loss of a part of the tonnage which is least attractive from the viewpoint of net revenue, and they can devote the released capacity in facilities and equipment to the long-haul and better-paying tonnage.

As in the case of competition of motor coaches in passenger service, the railways are entering the field of motor trucking by establishing highway freight service where it is more economical or gives better public service than by rail. In this field, however, railway activity is not as great as in meeting motor coach competition. Thus far the railway-controlled highway freight service is confined to substitution of trucks for way-freights or branch-line trains, or to serve as collecting or distributing media within metropolitan zones. To a small extent, a few railways have gone into the so-called "store door delivery" plan, under which the freight is called for or delivered by railway-controlled motor trucks. This practice is likely to be extended when the disputed points of carrier liability and extra charges for the service are satisfactorily settled.

The possibility of further inroads on railway revenues by highway competition depends in part upon Congressional action. To a large extent, motor vehicles, notably motor trucks, are unregulated except in minor particulars. In some states the authorities exercise certain police powers, especially with respect to motor coaches, but, broadly speaking, the trucks have a free hand in the matter of rates and assume no continuing obligation to serve. Under such circumstances, the railways have justification for complaint against unfair competition. Efforts have been made to enact a law which would place definite obligations upon common carriers by highway, and there was promise that action bearing upon motor coaches would be taken by Congress early in 1928. The bill, however, was not enacted. While it is probable that a similar bill affecting motor coaches may be passed in 1929, the likelihood of Federal regulation of trucks is more remote.

V. CHANGES IN FREIGHT AND PASSENGER RATES

The Federal Control Act, approved March 21, 1918, gave legislative sanction to the terms under which President Wilson, as an emergency war measure, took control of railways, effective January 1, 1918, and clothed the President with wide powers over the rates to be charged to the public for transportation service. During the period of Federal control of railways, the Interstate Commerce Commission, temporarily shorn of power to suspend rates initiated by the Director General of Railroads acting for the President, left the determination of rates and classifications in greater part with the Director General. To meet the extra burden of war-time prices of materials and the substantial increases in wages of railway employees, the Director General, on May 25, 1918, ordered a horizontal increase of approximately 25 per cent in freight rates and advanced the passenger rates to three cents per mile. Where the existing rate was higher than three cents per mile, no increase was ordered. Suburban fares were advanced 10 per cent. For the passenger service as a whole, the increase was approximately 18 per cent, to which was added a surcharge of one-half cent per mile on tickets used in Pullman cars.[9] Although strongly urged by the representatives of the railway corporations, during the second year of Federal control, to authorize further rate increases in recognition of further heavy increases in expenses, no further general advances in rates were authorized by the Director General. While numerous adjustments in individual rates were made, the majority were reductions rather than increases.

The fact that the rate basis in effect in 1919 was inadequate to insure a reasonable return to the railways was recognized by Congress in the Transportation Act of 1920. Into that law was written affirmatively a mandate to the Interstate Commerce Commission to establish rate scales which, under honest and economical management, would "as nearly as may be" yield to the railways as a whole, in territorial groups, a fair return on the value of property used in transportation service. The value was to be determined by the Commission. For the first two years the fair return was defined as 6 per cent, but the Commission was empowered to change that rate from time to time thereafter.[10]

Basing their estimates in part upon the book investment figures submitted by the railways, and in part upon the tentative physical valuation of approximately one-quarter of railway mileage, and taking into account the wage increases ordered on July 20, 1920, by the United States Railroad Labor Board, the Commission, effective August 28, 1920, authorized increases in freight rates of 40 per cent in the East, 25 per cent in the South, 35 per cent in the West, and 25 per cent in Mountain-Pacific territory. The weighted average was between 30 and 35 per cent. In passenger service, the ticket rates were advanced uniformly (about 20 per cent) throughout the country, bringing the standard rate to 3.6 cents per mile, and charges for Pullman car seats and berths were increased 50 per cent (the added charge to be retained by the railways rather than the Pullman Co.). These increases[11] were intended, under the estimated volume of traffic, operating expenses, and taxes for the following year, to yield 6 per cent on estimated property value, but, while the Commission apparently accepted without question the railway estimates of revenues and expenses, it was unwilling to accept the book value as the basis for computing the return. The railways' book cost at the time was given as slightly in excess of $20,000,000,000. The Commission, principally upon the basis of certain tentative valuation returns, arbitrarily wrote down the book value to $18,900,000,000. This reduction in the base was equivalent to cutting down the estimated return from 6 to 5.7 per cent on the book value of the railway investment.

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[9] The additional charge on tickets used in Pullman cars was discontinued late in 1918.

[10] "During the two years beginning March 1, 1920, the Commission shall take as such fair return a sum equal to 5½ per cent of such aggregate value, but may, in its discretion, add thereto a sum not exceeding one-half of 1 per cent of such aggregate value to make provision in whole or in part for improvements, betterments, or equipment which . . . are chargeable to capital account." (Sec. 15a). In 1922 the Commission set 5¾ per cent as the fair return, omitting any reference to an additional sum for capital improvements.

The carriers, however, were able to earn but a small part of the estimated net income in the first year under the new rates, because the volume of traffic in 1921 was very much smaller than the estimate. The earned return on book value was but 2.9 per cent.

The extent of the rate increases of 1920 was surprising to the shipping public, but, in that era of inflation and while business was booming, the higher transportation charges were accepted with little protest. Complaints began when the depression set in early in 1921, and throughout that entire year the railways and the Interstate Commerce Commission were besieged by requests for rate reductions. Many such reductions were made by the railways voluntarily, as previous relationships in absolute differentials in cents per 100 pounds between rates on certain commodities and between certain points were unduly disturbed by the horizontal percentage increases of 1918 and 1920. In the aggregate, the rate reductions were substantial, but they were not general enough to meet the widespread demand. The pressure of the agricultural bloc in Congress was focused upon the railways and the Commission. After hearings, the Commission ordered reductions in the rates on livestock, hay, and grain, and subsequently the railways voluntarily offered to reduce by 10 per cent the rates on all products of the farm, orchard, and ranch. The offer was approved by the Commission and the reduction became effective in October, 1921, but in the meantime the Commission instituted a prolonged inquiry into railway management and its relation to the rate scale as a whole.

Notwithstanding the meager net earnings of the carriers, the shippers' view, that the railway financial problem was but temporary and that lower rates would probably stimulate business, prevailed with the Commission. In May, 1922, a general reduction in freight rates was ordered, but passenger rates were not changed.

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[11] The general average increase for all classes of service was about 32 per cent.

Since then, there have been no general increases or decreases, but many changes, practically all downward, have been made either voluntarily or by Commission order. The efforts of the western carriers, beginning in 1924 and still continuing, to prove that their impaired financial situation justified a general advance in rates, have been unsuccessful. The Commission in 1926 definitely denied the application for a general 5 per cent rate increase, and has since ordered still further reductions in the rates on livestock and fruit.

The standard rate in passenger service has been 3.6 cents per passenger-mile since the advances of 1920. While that rate has been attacked from time to time, the demand has not been insistent or general. Such is not the case with respect to the Pullman ticket surcharge of 50 per cent. Complaint on that score has been bitter and continuous. The drive against the surcharge was carried into Congress, with a view to having it abolished by direct legislation. Such efforts, however, have fallen short of success, and, in the meantime, after investigation and hearings, the Commission declined in February, 1924, to order a change. Considering the passenger and freight services separately, the revenue and cost figures indicate that the net revenue from the transportation of passengers is relatively less than that from freight, and inasmuch as the carriers have not been earning and are not earning the promised fair return on value, it is obvious that the abolition of the surcharge would result in an even lower return for the service as a whole, or would require an advance in freight rates sufficient in degree to overcome the loss.[12] As has already been noted, the number of passengers in Pullman cars has been increasing steadily, notwithstanding the surcharge, while the number of passengers in coaches, under uniform rates since 1920, has been declining.

The average revenue per passenger-mile and per ton-mile are often used as indexes of average rates.[13] The two averages are significant, and

[12] In 1927, the passenger service operating expenses of Class I railways took 89.69 per cent of passenger service revenues; in freight service the ratio was 70.29 per cent. For all classes of service the operating ratio was 74.54 per cent.

[13] For comparative purposes the two averages are subject to qualifications and may not always reflect a true indication of rate levels. The general scale of passenger rates has not been changed materially since 1920, yet, because of the varying proportions borne to the total by through passengers carried under competitive rates, local passengers carried under the standard distance tariff of 3.6 cents per mile, and commutation passengers carried under very low passenger-mile rates, the average revenue per passenger-mile for all classes of service fluctuates from month to month and from year to year. In freight service the average revenue per ton-mile is influenced by the proportions of tonnage carried under very low rates and very high rates, as well as by the proportions of long-haul and short-haul tonnage. The general average is often affected as much by changes in volume of different commodities as by changes in rates.

they are given in Table 12. With the revenue units are shown the average hauls in each case, as well as the tonnage proportions of products of agriculture, mines and forests, as these commodities move under relatively low rates. For the passenger service the proportions of Pullman car passengers and commutation passenger-miles are given.

TABLE 12.—AVERAGE REVENUE PER TON-MILE AND PER PASSENGER-MILE WITH OTHER RELATED STATISTICS, CLASS I RAILWAYS, 1920 TO 1927

Year	Freight service			Passenger service				
	Average revenue per ton-mile	Average haul per ton	Per cent of total tons of products of agriculture, mines, and forests	Average revenue per passenger-mile	Average journey per passenger	Per cent Pullman passengers of all passengers[a]	Per cent commutation of total	
							Passengers	Passenger-miles
	Cents	*Miles*		*Cents*	*Miles*			
1920	1.052	181.55	72.08	2.745	37.94			
1921	1.275	181.48	73.87	3.086	36.03	3.0		
1922	1.177	184.30	70.85	3.027	36.66	3.3	44	17
1923	1.116	176.86	72.57	3.018	38.46	3.5	45	17
1924	1.116	178.85	71.60	2.978	38.70	3.7	47	18
1925	1.097	179.59	71.05	2.938	40.47	4.0	49	18
1926	1.081	179.99	71.80	2.936	41.14	4.2	52	19
1927	1.080	181.47	71.36	2.896	40.55	4.2	54	20

[a] Pullman passenger-miles not available.

The fluctuations in percentage volume of low-grade commodities, except in 1921 when the tonnage of agricultural products was heavier than usual, are not substantial, nor are there any noticeable variations in the average haul. These two factors, showing no noticeable change in the average revenues per ton-mile, may be taken as fairly indicative of the effect of rate reductions in 1921 and subsequent years. The full effect of the 1920 increases bore upon the traffic of 1921, and subsequent decreases held down the averages of later years. Since 1921, the average receipts per ton-mile have declined steadily from 1.275 cents in that year to 1.080 cents in 1927.[14]

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[14] If the total ton-miles of 1927 had moved under the average ton-mile revenue of 1921, the public would have paid to the railways in freight revenue $835,810,950 more. By the same process of computation, the savings to the public in other years, and the grand total 1922 to 1927, inclusive, for freight service only, were as shown in the following statement:

1922	$332,499,300
1923	656,235,930
1924	617,579,850
1925	736,588,920
1926	860,867,240
1927	835,810,950
Total	$4,039,582,190

In passenger service, the decline in the average receipts per passenger-mile, as already noted, is attributable in but small part to reductions in rates, although the practice of offering reduced rates for excursions and for other special purposes has been extended. The lower average revenue is attributable rather to the heavy losses in local passengers paying the standard rate of 3.6 cents per mile, and slight increases in both the long-distance passengers (carried at rates in many cases somewhat less than standard) and in commutation passengers who enjoy subnormal rates. The substantial and consistently continuous increase in the proportion of Pullman car passengers to total passengers carried is noticeable.

Inasmuch as the drop in average receipts per passenger-mile is due principally to causes other than changes in rates, it would not be proper, as in the case of freight service, to assume that the lower average actually saved any money to the public. As a matter of fact, the commutation rates in several cases have been increased.

VI. CHANGES IN RELATIONS BETWEEN RAILWAY MANAGEMENT AND EMPLOYEES[15]

The railways emerged from the period of Federal control with lowered employee morale.[16] The centralization of power in the Director General, and in the bipartisan boards organized by him, had appreciably weakened the authority of the managers of the individual carriers.* The strength of railway labor unions and the prestige of their leaders had been substantially enhanced by the large wage increases and many concessions made during the war period. The first general increase affecting all employees was announced in May, 1918, retroactive to January 1, 1918, and several supplementary increases to separate classes, such as shopmen, were granted in 1919. Altogether the wage increases, or their equivalent in shortening of the working day, payment of punitive overtime rates, and other changes which affected the pay roll favorably from the point of view of the employee, added about $1,000,000,000 per year to total wages, or about $500 per employee per year.

In the closing months of the period of Federal control, the railway labor unions attempted to obtain further increases, but the Director General refused, urging the employees to be patient and hold their petitions for determination by the Railroad Labor Board to be created by the Transportation Act, then under consideration by Congress.

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[15] See Labor Relations, Chap. II, Industry, Part 1, pp. 87, 90; Chap. III, Construction, p. 251; Chap. IV, Transportation, Part 2, p. 315; Chap. VI, Labor, p. 479; Chap. VII, Management, pp. 514–531.

[16] The lower employee morale was not peculiar to railways but was common to industry in 1920.

* Any inference that a lowered morale of employees was associated with the strengthening of the unions under bipartisan boards of adjustment is, in my opinion, unfortunate. The lowered morale was due largely to the fact that in 1919 the cost of living had risen much more than wages.—Note by George Soule, Director.

The Railroad Labor Board, created by the Transportation Act of 1920, consisted of nine members: three representing each group, employees, management, and the public. Its first decision was made under great pressure for quick action, on July 20, 1920. It granted increases which averaged about 22 per cent to practically all employees, or at the rate of over $600,000,000 per year. During the remainder of 1920 and until 1926 (when it was abolished), the Board was kept busy with disputes which should have been dealt with by adjustment boards. The law intended that the Railroad Labor Board should deal primarily with wage rates and broad working conditions, as provision was made also for the organization of bipartisan adjustment boards, subordinate to the Labor Board, to deal with disputes concerning rules and working conditions. But the creation of such adjustment boards was made optional rather than mandatory, and the law left for joint determination by labor and management whether such boards should be on a national, regional, or system basis. The unions affiliated with the American Federation of Labor,[17] viewing with satisfaction the substantial accomplishment in standardization during Federal control, insisted upon national boards. To this the railways would not agree. By majority action they stood out for system boards. A minority of railway executives were willing to compromise on regional boards, but were outvoted. Thus the two parties were deadlocked, and as a matter of fact no affirmative action was ever taken in organizing the adjustment boards contemplated by law, although many system boards were formed by mutual consent subsequent to 1922.

The record of the Railroad Labor Board was one of trouble with both labor and management, and of internal strife after the first year of its existence. Shortly subsequent to its award of an increase of 22 per cent in wages in July, 1920, the depression of 1921 and the serious impairment of railway net income were apparent, and the carriers petitioned the board to cut wages to the level of 1920. Hearings were begun in January, 1921, but no decision was announced until June, when the Board authorized a 12 per cent reduction. This left the wage scale about 8 per cent above the 1920 base. The result was disappointing both to labor and to management. The latter had hoped for a much deeper cut, and announced their intention to move for further decreases. Smarting under the 12 per cent reduction, the possibility of further losses was met by the train service employees by a threat to strike, and in June, 1921, a serious dispute was narrowly averted by the acceptance of the wage reduction, with an implied assurance on the part of the managers that requests for further decreases would be withheld. The train service brotherhoods were not subsequently asked to accept wage cuts, but in 1922 the Labor Board, acting upon petition from the railways, authorized a second cut in wages or abridgment of favorable rules, adversely affecting the interests of other classes of employees, notably the shop crafts and trackmen.

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[17] Practically all except the four train service brotherhoods.

That order, which brought down the wages of the shop crafts approximately to the scale of March, 1920, and took away the increases of June in that year, precipitated one of the most extensive, serious, and protracted strikes in railway history. Acting against the findings of the Labor Board, the shopmen refused to accept the cut and walked out on July 1, 1922, the date on which the lower rates were to become effective. The strike was directed not only against the wage reduction but also against the growing practice of some companies to give their equipment repair work to outside shops not subject to Labor Board rulings, and against the negative attitude of railway managers toward national adjustment boards.

The shopmen's strike was a failure and it cost them much in impaired prestige. A minority of the roads entered into a compromise agreement, influenced in part by the desire of the managers to get back their experienced employees to take the place of the inefficient strikebreakers, and in part by the desire of the labor leaders to prevent further damage to union prestige. On those roads, the strikers, when taken back without sacrifice of seniority rights, accepted the Labor Board rates, but, on the majority of the railroads, new shopmen were recruited and retained, and the number of strikers taken back eventually as new employees was but a small proportion of those who walked out. One indirect benefit to the shopmen was the abandonment of the policy of contract repairs in outside shops, but, in the matter of adjustment boards, the effect was to foster the organization of such boards on a system basis and to bring into being many "company unions" of shopmen unaffiliated with the national unions.

The policies of the Railroad Labor Board in connection with the shopmen's strike, its apparent inability to cope with the problem of adjustment boards (in the meantime having itself to pass upon a large volume of small disputes which should have been handled by adjustment boards), its failure to command full respect from either party, and a general belief on the part of the public that the Board was not functioning effectively, led to an agitation for its abolishment. Friction within the Board itself (between the representatives of labor and of the public) had no small part in the final outcome, but action was precipitated by the refusal of enginemen and firemen in western territory to obey a summons to appear before the Board and to take part in the hearings on a wage issue properly before the Board for determination. Subsequently, the employees refused to abide by the Board's decision amending certain rules, and by strike threat coerced the railways into agreeing to a wage increase without amendment of rules. Refusal to abide by findings of the Board was not confined to employees, as one important carrier in eastern territory insisted upon carrying out a policy of employee representation contrary to Board ruling, and carried the issue into the courts. The decision was that the Board had no legal power to enforce its orders. In a few other cases the rulings of the Board were not observed by the carriers, notably in the prolonged continuance of the subterfuge of "farming out" maintenance work by contract to outside companies, virtually subsidiaries of the carriers, so as to place the employees affected outside the jurisdiction of the Board. That unethical procedure was eventually abandoned, but it was continued long enough to justify labor in asserting that defiance of the Board was practiced by the carriers as well as by the labor organizations, and that the blame for thus impairing the usefulness of the Board must be assumed in part by railroad management.

On the part of railway managers, the attitude of the majority was that the Board should be continued and strengthened by an amendment to the law giving it further powers, but as there appeared to be no likelihood that Congress would enact strengthening legislation, in view of labor opposition to the Board, no definite concerted stand was taken.

On the part of employees, the principal objection to the Board was against the public members who held the balance of power and who were regarded, unfairly perhaps, as antagonistic to labor.

Efforts were made by labor in 1925 to enact the Howell-Barkley Bill with its "closed shop" principle, and the bill was almost enacted.* Alarmed at the prospect of passage of such a law, and realizing that under the existing political conditions the Railroad Labor Board would not be continued, the railway executives sought a compromise which would give to labor the principal objectives it sought and yet would avoid the drastic proposals of the Howell-Barkley Bill. The results of joint conferences were embodied in the Watson-Parker Bill, introduced in January, 1926, and enacted in May, 1926.

An unusual feature of that legislation, dealing as it does with highly controversial matters, was the unanimity of support. The bill was advocated not only by the railway labor unions but also by a large majority of railway executives, and its passage was recommended by the President. The opposition, never formidable, was confined to a few representatives of manufacturers and shippers, who feared collusion between management and labor to increase wages and then to advance rates, and to a small minority of railway executives who insisted that the bill was wrong in principle and a compromise which would react unfavorably upon the public.

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* It should be understood that the railway unions do not practise the "closed shop" in the sense in which that term is used by most well-informed students of labor relations—in other words, they do not ask the employer to agree to employ no nonunion men. The Howell-Barkley bill merely embodied a plan to conduct labor relations through the standard national labor organizations, as opposed to the "company unions" established by employers.—Note by George Soule, Director.

The essential difference between the 1926 and the 1920 laws lies in the elimination of public representation in the determination of wages, and in the elimination of compulsory arbitration. The 1920 law compelled arbitration but did not compel acceptance, while the 1926 law made arbitration voluntary but provided that the arbitral awards must be accepted. Instead of a continuing tribunal of nine men, three of whom represented the public, with a formal procedure of public hearings, complete records, and reported decisions, the new law has created a Board of Mediation of five members, appointed by the President, who may intervene in wage disputes and solely by process of mediation move to avert trouble. The new Board has no powers in summoning witnesses or holding public hearings, but acts solely as a peace-making body in harmonizing differences in point of view. If unable to bring about an amicable adjustment, the Board is required to make an effort to induce the disputants to agree to arbitration under procedure set forth in the law, the decision to be binding upon all parties. In the event of failure of mediation, or unwillingness of either or both parties to arbitrate, the Board of Mediation, if it believes that the dispute may substantially interrupt traffic, is required to notify the President who, in his discretion, is authorized to create a "fact-finding" emergency board to investigate and report to him within 30 days. The law provides further for a "cooling off" period. After the creation of the "fact-finding" board, and for 30 days subsequent to the date of its report, no change, except by agreement, shall be made by the parties to the controversy in the conditions out of which the dispute arose.

Since the creation of the Board of Mediation, there have been no labor disputes which the Board could not adjust. The years 1926, 1927, and 1928 have been free from interruptions to traffic by strikes. For such freedom, credit belongs in part to the Board. Yet the efficacy of mediation, arbitration, and emergency "fact-finding" has not thus far been thoroughly tested. Since 1926, there has been a general upward revision in wage rates without any serious dispute. The Board of Mediation has been of service in the adjustment of differences, but in the main the concessions have been made by the carriers. No attempt has been made to reduce wages.[18]

[18] In but two cases (in May and October, 1928) has the appointment of a "fact-finding" emergency board been necessary. The first case involved the continuation of substandard wage rates on a weak road which, because of peculiar conditions of light traffic, could hardly meet its operating expenses. A strike was ordered to enforce

Some critics have contended that the railway executives have been too willing to concede to organized pressure for higher wages and more favorable rules affecting employment, and that, by concerted and firm resistance, they might have made better bargains with their employees and thereby held down operating expenses which the public must pay in transportation charges. Such criticism, however, overlooks the prime obligation of management to provide continuous service to the public. Ill feeling engendered by strife would react quickly on transportation service, and strikes would be highly demoralizing. Public opinion in crises of that kind is not likely to side with the corporations. Except in isolated and unimportant cases, the wages of railway workers cannot be said to be too generous. The high grade of transportation service since 1923 has increased the public goodwill toward railways, an asset not lightly to be jeopardized. The morale of the service in 1928, in contrast with that of 1920, has been high, and the employees and management have co-operated in increasing operating efficiency.

TABLE 13.—EMPLOYEES AND THEIR COMPENSATION, CLASS I RAILWAYS, 1920 TO 1927, INCLUSIVE[a]

Year	Average number of employees	Total hours worked	Hours per employee	Total compensation	Average compensation	
					Per hour	Per year
		Thousands		*Thousands of dollars*		
1920	2,022,832	5,446,741	2,693	3,681,801	$ 676	$1,820
1921	1,659,513	4,147,319	2,499	2,765,218	667	1,666
1922	1,626,834	4,311,897	2,650	2,640,817	613	1,623
1923	1,857,674	4,928,651	2,653	3,004,072	.610	1,617
1924	1,751,362	4,534,879	2,589	2,825,775	623	1,613
1925	1,744,311	4,531,361	2,598	2,860,600	.631	1,640
1926	1,779,275	4,671,736	2,626	2,946,114	631	1,656
1927	1,734,470	4,517,694	2,605	2,909,217	644	1,677

[a] The total compensation includes overtime and other pay roll allowances The number of employees is the average of quarterly counts. The statistics include general officers as well as all others on railroad pay rolls The average yearly compensation is subject to qualification as to the count of employees, but as the same basis was used in each year the comparison is at least indicative.

The average number of employees, their aggregate annual compensation, and the average yearly compensation per employee are shown in Table 13. The tendency in average hourly and yearly compensation

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the demand for standard wages but the order was suspended when the emergency board was appointed, and its report in favor of a continuation of substandard wages (previously approved by the abolished Labor Board) assisted in effecting a compromise between the management and its employees. The second case was a dispute between the western railways and their conductors and trainmen, over the extent of a wage increase and its relation to certain restrictive rules. The differences were settled after the publication of a report by the fact-finding board.

was downward from 1920 to 1923, and since then the tendency has been upward. It is interesting to note that, although the volume of freight traffic in 1926 was nearly 8 per cent greater than in 1923, the number of employees was 7 per cent less and the number of man-hours was 8 per cent less. The year 1920 was abnormal, as it was affected by influences carried over from the period of Federal control.

It may be of interest here to utilize a summary, prepared by the Bureau of Railway Economics, showing the distribution of railway operating revenues The item of labor (salaries and wages) is, of course, the largest in the group. In 1920, labor was paid 55.4 cents out of each dollar of operating revenues. In 1921, the proportion had dropped to 46.9 cents, and since then the tendency has been downward: 44.4 cents in 1922, 44.3 cents in 1923 and 1924, 43.2 cents in 1925, 42.6 cents in 1926, and 43.9 cents in 1927. The smaller part of revenues taken by wages was influenced by the improved operating efficiency, elsewhere discussed.

The improvement in efficiency may be shown by comparing the total employee hours with the total traffic units. Although the practice of computing such units, by adding to the ton-miles a multiple of the passenger-miles, is open to some objection, it is not improper to use it here. The commission in rate cases has occasionally employed the basis of considering one passenger-mile as equivalent to three ton-miles (roughly proportional with revenue). On that basis, the number of traffic units per man-hour in 1920 and 1921 was 101. In 1922, it was 103; in 1923, 107; in 1924, 109; in 1925, 115; in 1926 (the high record), 118; and in 1927, with somewhat less traffic, 117. These figures indicate that the output per man-hour in 1926 was 17 per cent more than in 1920 and 10 per cent more than in 1923. The larger part of the increased productivity per man-hour is attributable to better equipment and more adequate facilities, but the record would not have been as favorable without the improvement in morale and degree of employee co-operation.[19]

VII. CHANGES IN INDEXES OF OPERATING EFFICIENCY

A comparison of the operating statistics of 1927 and 1928 with those of the first years of the postwar period reveals striking gains in railway operating efficiency. In nearly every index of equipment utilization, train and terminal operation, and output per man-hour, the improvements are notable. These improvements, and the related public benefits in a higher quality of transportation service, are attributable in part to the large expenditures for additions and betterments to facilities and equipment, in part to changes in operating methods and better managerial control, in part to higher employee morale, and in part to a better understanding and more cordial co-operation on the part of the shipping public.

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[19] See Productivity per Worker, Chap. II, Industry, Part 1, p. 81; Part 2, pp. 98, 103, 142, 164; Chap. III, Construction, p. 248; Chap. VI, Labor, p. 447; Chap. VII, Management, pp. 512–513.

Freight Car Performance.—The fact has already been touched upon that there have been few net additions to the number of freight cars, and an actual decrease in the number of locomotives since the war period. In 1920, the equipment was inadequate to take care of traffic demands, as there were car shortages, congestions, embargoes, and other serious interruptions. In 1926, however, when the total revenue ton-miles were 8 per cent more than in 1920, there was complete freedom from car shortage and congestion, and the quality of public service was never higher.

The best index of freight car utilization is net ton-miles per car-day. In it are combined the carload, the miles per car-day, and the per cent loaded of total car-miles. Since the total number of cars—serviceable in use, serviceable stored, and unserviceable—is taken as the divisor, the net ton-miles per car-day should be greatest in periods of heavy traffic, unless the volume is so heavy as to cause congestion, or other factors (such as delays in loading and unloading, light carloads, or a high percentage of empty car-miles) interfere with the usual efficiency in car utilization.

TABLE 14.—FREIGHT CAR PERFORMANCE, CLASS I RAILWAYS, 1920 TO 1927, INCLUSIVE

Year	Total net ton-miles	Average cars on line daily	Car-miles per car-day	Tons per loaded car	Per cent loaded	Ton-miles per car-day
	Millions	*Thousands*				
1920	440,125	2,464	25.1	29.3	67.9	498
1921	344,343	2,425	22.4	27.6	63.0	389
1922	375,617	2,429	23.5	26.9	67.2	424
1923	457,590	2,461	27.8	27.9	65.7	509
1924	429,453	2,486	26.9	27.0	65.1	472
1925	456,265	2,527	28.3	27.0	64.5	493
1926	488,578	2,518	30.4	27.4	63.7	532
1927	474,683	2,509	30.3	27.2	62.9	518
1928[a]	397,369	2,481	32.0	26.6	63.3	525

NOTE.—Total net ton-miles include nonrevenue as well as revenue freight; cars on line daily include private line cars

[a] First 10 months.

The figures in Table 14 show the relation between traffic volume and net ton-miles per car-day. The high record of 1926 (532 net ton-miles per car-day) was made in the year of greatest traffic. The two factors, however, are interdependent. The record volume of traffic could not have been moved if cars had not been efficiently utilized, nor could the high record in ton-mile production per car have been attained with less traffic, since the divisor—the number of cars—is fairly constant. This interrelation must be considered in passing judgment on car performance.

It will be noted that the principal improvement has been in car-miles per car-day. The better movement is the result of less delay in yards and terminals, less time taken by shippers and consignees for loading and unloading, better distribution through control by the American Railway Association, and an increase in train speed. In the factor last named, the gain has not been so much in the actual speed while in motion as in the reduction of road delays. The running speed is probably little, if any, faster than in the previous years, but the increase in multiple running tracks, the better design of locomotives, the installation of additional automatic signals, and the enlargement of yards and terminals have materially cut down stand-by losses on the roads and have favorably affected the over-all train speed between terminals.

When the railway executives in 1923 set for themselves certain objectives to be attained, they named 30 miles per car-day and 30 tons per loaded car. The miles per car-day in 1923 were 27.8, but previously the average had been considerably lower. The 30 miles per day objective was reached in 1926, and has since continued, even with less traffic. The carload objective has not been attained, and the tendency is toward a smaller average load. It was 27.9 tons in 1923, when the 30-ton objective was set, but in no subsequent year has the 1923 load been maintained. It was 27.4 tons in 1926, 27.2 tons in 1927, and 26.6 tons during the first ten months of 1928. The smaller carload is the result of the changing purchasing habits under conditions which call for smaller but more rapidly moving inventories. It is also the result of the tendency in freight classification changes to establish lower minimum weights for which car-load rates apply.

The per cent borne by loaded car-miles to total car-miles has an important bearing upon car performance. Table 14 shows a steady decline in that unit since 1922. It was low in 1921, because of the abnormal movement of empties to the owning road, in the process of "unscrambling" cars used with virtual disregard of ownership during Federal control. Since then, the decline has been steady and consistent—from 67.2 per cent in 1922 to 62.9 per cent in 1927, with a slight increase to 63.3 per cent in the first ten months of 1928. This loss in efficiency is one item of expense in improving public service, as the growing per cent of empty mileage is brought about in part by orders from the American Railway Association's Division of Car Service, which has power to require the distribution of cars in advance of territorial and seasonal needs, and in part by a slightly higher proportion of freight in cars of special design, which invariably move empty on the return trip. The cross-hauling of empties from one section to another section of the country is now being done to a greater extent than formerly. While it reduces the per cent loaded of total, that disadvantage is more than offset by having the cars where they are needed when they are needed and thereby avoiding the delay which ensues when shippers are obliged to wait for suitable cars.

An analysis of comparative car performance in 1923 and 1927 is interesting. The net ton-miles of 1927 were about 4 per cent greater than in 1923, and the freight cars on line daily were about 2 per cent greater. The 1927 average daily movement per freight car increased about 9 per cent, but the average load declined 2.5 per cent, and there was a loss of 4.3 per cent in loaded car-miles. The net result of these changes was an increase of about 2 per cent in net ton-miles per car-day, as the gain in car-miles per car-day was greater than the losses in the carload and per cent of loaded miles.[20] In this factor in car performance, railway management has made a distinctly creditable gain. The loss in the average carload is largely beyond railway control, and the decline in the per cent loaded of total car-miles is one element in the price of improved public service.

Locomotive Performance.—In locomotive utilization, the only available statistical information is the average miles per locomotive-day. As in the case of freight cars, the divisor is the total number of locomotives—serviceable in use, serviceable stored, and unserviceable. The average miles per locomotive-day, therefore, other factors remaining unchanged, would be greatest when traffic is heavy and all serviceable locomotives are utilized, and least when traffic is light and part of the serviceable locomotives are stored. In 1921, a year of low traffic volume, the average per freight locomotive-day was 49.9 miles. In 1922, it was 52 miles, and in 1923 it was 60.3 miles. Since then, there has been little change, but the tendency is upward—61 8 miles in 1926 and 60.9 miles in 1927. The improvement may be attributed in part to the factors which affect train operation (next to be discussed), in part to the general practice of increasing the length of the locomotive run, and in part to expenditures devoted to the improvement of engine terminals and shops. In passenger service, the increase in miles per locomotive-day is slightly greater than in freight service—108.7 miles in 1923 and 114.4 miles in 1927.

Freight Train Performance.—In freight train service, the significant units are (a) the gross train load, (b) the net train load, (c) the average train speed between terminals, and (d) the gross ton-miles per train-hour. The data for the years 1920 to 1927, inclusive, are given in Table 15.

In every year since 1921, the train load, both gross and net, has shown an increase. In every year, except 1923, the train speed has

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[20] If the carload and the per cent of loaded miles had been the same in 1927 as in 1923, the higher car-miles per car day of 1927 could have released 267,000 cars, had additional traffic called for them. Under traffic conditions at present an increase of one mile in the average car-miles per car day is equivalent to releasing approximately 100,000 cars, or conversely, a loss of one mile per car day is equivalent to taking 100,000 cars out of service.

TABLE 15.—FREIGHT TRAIN PERFORMANCE, CLASS I RAILWAYS, 1920 TO 1927, INCLUSIVE

Year	Train load		Speed in miles per hour	Gross ton-miles per train-hour
	Gross tons	Net tons		
1920	1,443	708	10.3	14,876
1921	1,435	651	11.5	16,555
1922	1,466	677	11.1	16,211
1923	1,539	713	10.9	16,768
1924	1,588	715	11.5	18,261
1925	1,670	744	11.8	19,679
1926	1,737	772	11.9	20,705
1927	1,780	778	12.3	21,945
1928[a]	1,839	793	12.8	23,623

NOTE.—Gross and net tons include nonrevenue freight. Gross tons include the weight of both cars and contents. Net tons include the weight of contents only.

[a] First 10 months of 1928.

gained. The most notable improvement is in gross ton-miles per train-hour, an increase from 16,555 in 1921 to 21,945 in 1927, a gain of nearly 33 per cent in six years. The performance during the first 10 months of 1928 was substantially better than in the same period of 1927.

Gross ton-miles per train-hour, as a unit of freight train performance, combines the factors of load and speed. While the trainload in itself is significant, it must be considered together with train speed, as gains in loading may be offset by losses in speed when overloading causes delay. Train expenses vary more with train-hours than with train-miles. In the past few years greater attention has been paid to the time element, and by reductions in road delays the train speed has been steadily gaining with the heavier trainload. Train-miles or train-hours should be regarded as expense; ton-miles as product. The pronounced gain in product per unit of work (gross ton-miles per train-hour) is another distinctly creditable achievement.

Fuel Consumption.—Because of improved locomotive design, reductions in grades and curvature, better train loading, less road delay, and improved technique in firing, the railroads are producing more ton-miles per ton of coal (or its equivalent in oil).[21] In 1921, the coal consumption per 1,000 gross ton-miles[22] was 162 pounds. In 1922, there was a slight loss, as 163 pounds were burned. In 1923, the consumption was the same as in 1921, but since then a steady improvement is shown—149 pounds in 1924, 140 pounds in 1925, 137 pounds in 1926, and 130 pounds in 1927. During the first 10 months of 1928 it was 125 pounds. If the 1927 gross ton-miles had been produced under 1921 fuel efficiency, the fuel consumption in 1927 would have been 19,000,000 tons more than were actually burned. The savings were over 19 per cent.

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[21] See Improvement in Power Plant, Chap. II, Industry, Part 2, pp. 119 et seq.; Chap. IV, Transportation, Part 2, p. 312.

[22] Including weight of locomotive and tender.

In passenger service, the fuel consumption record is similar, but both the degree and the absolute savings are smaller. In 1921, the fuel burned per passenger train car-mile was 17.7 pounds; in 1927, it was 15.4 pounds. The actual consumption in 1927 in passenger service would have been about 4,335,000 tons greater if burned under 1921 efficiency. The savings in that service were 13 per cent. The data for switch service are not available, but it is probable that corresponding reductions were made in that class of service. For train service alone, the 1927 fuel costs (at $2.66 per ton, the average price f.o.b. line) would have been about $62,071,000 more if fuel had been burned with the same efficiency as in 1921.

Unserviceable Equipment.—The greater productivity of equipment during the past five years is due in part to higher standards of maintenance. The 1923 program, to which the railway executives pledged themselves, set among other objectives a goal of but 5 per cent unserviceable freight cars and but 15 per cent unserviceable locomotives. At the close of 1922, the number of freight cars out of service for repairs was 9.1 per cent of total cars, and 26.4 per cent of freight locomotives were unserviceable. The averages by years since 1920 are shown in Table 16.

TABLE 16.—UNSERVICEABLE EQUIPMENT, CLASS I RAILWAYS, 1920 TO 1927, INCLUSIVE

Year	Unserviceable freight cars	Per cent of total	Unserviceable freight locomotives	Per cent of total
1920	252,000	7.0	7,378	24.5
1921	320,000	13.2	7,317	23.4
1922	311,000	12.8	8,394	25.5
1923	197,000	8.0	7,118	21.6
1924	216,000	7.8	6,256	18.8
1925	195,000	7.7	5,791	17.8
1926	164,000	6.5	5,197	16.4
1927	148,000	5.9	4,988	16.1
1928[a]	155,000	6.2	4,919	16.2

[a] First 10 months

While the objectives have not been fully attained, the reductions in "bad order" equipment have been substantial. Compared with 1921, the year before the shopmen's strike, the 1927 maintenance policies have made available for service 172,000 additional freight cars and 2,329 additional freight locomotives. The gain in passenger locomotives was similar in degree. In 1921, the per cent of unserviceable passenger locomotives was 22.4 per cent; in 1927 it was 16.4 per cent.

Composite Index of Operating Efficiency.—In a review of railway operations in 1927,[23] Dr. J. H. Parmelee, Director of the Bureau of Railway Economics, suggests a method of combining the several indexes of operating efficiency in one composite unit. His method is to take each efficiency factor separately, to compute an index number for that factor by relating it on a percentage basis to some previous level, and then to combine all the indexes computed for the different factors into a common or average index. He took the following 13 factors:

1. Car-miles per car-day
2. Net ton-miles per car-day.
3. Gross tons per train.
4. Net tons per train.
5. Gross ton-miles per train-hour.
6. Net ton-miles per train-hour
7. Locomotive-miles per locomotive-day, freight.
8. Locomotive-miles per locomotive-day, passenger.
9. Percentage serviceable locomotives, freight
10. Percentage serviceable locomotives, passenger.
11. Percentage serviceable freight cars.
12. Fuel consumption per unit, freight.
13. Fuel consumption per unit, passenger.

Using the composite averages of the years 1920–1924 as the base of 100, he found that the composite averages of subsequent years were as follows: 1924, 104.8; 1925, 109.4; 1926, 113.5; and 1927, 115.2.

While his method may be questioned because it gives equal weight to each single factor and because some of the factors are elements in other factors (such as 1 and 2), nevertheless the comparison in a general way is sound and indicates that the year 1927, even with less traffic than that of 1926, reflected a further gain in operating efficiency—a gain of 15.2 per cent over the average of 1920 to 1924, inclusive.

Purchasing and Stores Administration.—While railways, unlike manufacturers and merchants, do not carry large inventories in raw materials and merchandise, they do have substantial sums of capital tied up continuously in fuel and other material and supplies for maintenance, train operation, and construction. In 1920, the balance sheet for all railways considered as one system carried an item of $767,266,510, representing material and supplies held for use. In each succeeding year, except 1923, there was a decrease. In 1927, the item was $532,063,111, a reduction of $235,203,399. Part of the decrease was due to lower prices, but the major savings were attributable to improvements in purchasing policies and storekeeping. The railways themselves are taking advantage of better transportation service and have found, like manufacturers and merchants, that rail service has so improved in regularity and dependability that smaller stocks of supplies may be carried without fear of interruption to maintenance work. The carrying charges on a dollar of surplus material are around 16 cents (6 per cent for interest and 10 per cent for depreciation, obsolescence, taxes, and insurance). That percentage, applied to a saving of $235,203,399 in surplus material, indicates that operating expenses and other costs for material held for use were $37,632,000 less in 1927 than in 1920. While a part of the saving is the result of lower prices, the estimated savings are indicative also of the success of efforts to improve the administration of purchases and stores.[24]

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[23] *Railway Age*, January 7, 1928.

Operating Revenues and Expenses.—In order that attention may be drawn to certain features of the income account, the revenues, expenses, taxes, and net operating income of Class I railways are given in condensed form in Table 17.[25]

TABLE 17 —REVENUES, EXPENSES, and NET OPERATING INCOME, CLASS I RAILWAYS, 1921 TO 1927

(In millions of dollars)

Item	1921	1922	1923	1924	1925	1926	1927
OPERATING REVENUES							
Freight	3,911	3,992	4,607	4,334	4,542	4,798	4,631
Passenger	1,152	1,074	1,146	1,075	1,056	1,042	975
Other	454	493	537	512	525	543	528
Total	5,517	5,559	6,290	5,921	6,123	5,383	6,134
OPERATING EXPENSES							
Maintenance of way and structures	756	729	814	793	816	867	868
Maintenance of equipment	1,251	1,253	1,465	1,260	1,259	1,283	1,219
Transportation	2,252	2,140	2,310	2,141	2,128	2,172	2,127
Other .	304	293	306	314	334	347	359
Total	4,563	4,415	4,895	4,508	4,537	4,669	4,573
Taxes	276	301	332	340	359	389	376
Joint facility and equipment rents, net debit[a]	70	83	101	99	106	112	117
Net railway operating income	608	760	962	974	1,121	1,213	1,068

[a] Including uncollectible operating revenues and miscellaneous operations

Since 1921, there have been two peaks in the curve of railway operating revenues, the first in 1923 and the second in 1926. The latter now stands as the high record. Neither peak was notably pronounced—from

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[24] See Size of Inventory, Chap. III, Construction, pp 235, 242; Chap. V, Marketing, pp. 332, 344, 350; Chap. VII, Management, pp. 508 et seq , 537.

[25] The tabulation begins with the year 1921 because the year 1920 was affected so much by abnormal conditions (the closing two months of Federal control, six months of guarantee period, and four months of complete corporate control) that it is not suitable as a base for comparison. The year 1921 also is not entirely satisfactory as a starting point, as it was adversely affected by business depression and subnormal traffic.

$5,517,000,000 in 1921 to $6,290,000,000 in 1923, an increase of 14 per cent and to $6,383,000,000 in 1926, a further increase of 2 per cent over 1923, or an extreme range of but 16 per cent between the lowest and highest earnings of the seven-year period.

The degree of fluctuation in operating expenses was even less. The expenses of 1923 were but 7 per cent greater than in 1921, although revenues were 14 per cent better. The expenses of 1926, with additional revenues of 2 per cent, were 5 per cent less than in 1923. Since 1924, operating expenses have been fairly constant, the extreme range being from $4,508,000,000 in 1924 to $4,669,000,000 in 1926. In 1927, they were but 0.2 per cent more than in 1921, although the revenues were 11 per cent greater and the ton-miles (Table 10) were 38 per cent greater. The loss in passenger business and the reduction in freight rates explain the difference between the relative changes in revenues and ton-miles.

The growth in the burden of taxation is noticeable. In the seven-year period, the increase in taxes was from $276,000,000 to $376,000,000, or 36 per cent.

The changes in net railway operating income, and their relation to property investment, will be discussed later.

TABLE 18.—DISTRIBUTION OF THE DOLLAR OF OPERATING REVENUE, CLASS I RAILWAYS, 1921 TO 1927, INCLUSIVE

Item	1921	1922	1923	1924	1925	1926	1927
OPERATING REVENUES	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*
Freight	70.9	71.9	73.2	73.2	74.2	75.2	75.5
Passenger	20.9	19.3	18.3	18.2	17.3	16.3	15.9
Other	8.2	8.8	8.6	8.6	8.5	8.5	8.6
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0
OPERATING EXPENSES							
Maintenance of way and structures	13.7	13.2	12.9	13.4	13.3	13.6	14.1
Maintenance of equipment	22.7	22.5	23.3	21.3	20.5	20.1	19.9
Transportation	40.8	38.5	36.7	36.2	34.8	34.0	34.6
Other	5.5	5.2	4.9	5.3	5.5	5.4	5.9
Total	82.7	79.4	77.8	76.1	74.1	73.1	74.6
Taxes	5.0	5.4	5.3	5.7	5.9	6.1	6.1
Joint facility and equipment rents, net debit[a]	1.3	1.5	1.6	1.7	1.7	1.8	1.9
Net railway operating income	11.0	13.7	15.3	16.4	18.3	19.0	17.4

[a] Including uncollectible operating revenues and miscellaneous operations

The changing relationships between the principal classes of traffic and total revenues, and between the principal groups of operating expenses and total, as well as the relationships between expenses, taxes, and net operating income and gross revenues are depicted in Table 18.

Under operating revenues, the notable change is in the relative proportions of freight revenue and revenue from the sale of passenger tickets. In 1921, freight revenue was 70.9 per cent and passenger revenue 20.9 per cent of the total. The freight proportion has steadily increased and the passenger proportion has steadily decreased in each year, so that in 1927 the percentages of total were 75.5 and 15.9, respectively. All other revenues combined show practically no relative change—8.2 per cent in 1921 and 8.6 per cent in 1927.

The proportion of revenues taken by expenses has shown a distinctly downward tendency—from 82.7 per cent in 1921 to 74.6 per cent in 1927. The lowest point was in 1926, when the operating ratio was 73.1 per cent.[26] Among the general accounts, the principal reduction in the ratio is found in transportation expenses—40.8 per cent of revenues in 1921 and 34.6 per cent in 1927—although a smaller reduction is noted also in equipment maintenance. A comparison with earlier periods would show that the two maintenance accounts have been constituting a larger part of the whole during the past two decades, especially the equipment maintenance group. The explanation is that the capital expenditures yield their greatest return in reduction in transportation expenses, but tend to increase the burden upon maintenance. The transportation savings are greater than the added maintenance costs, and the net result is a decrease in the total operating ratio.

In view of rate reductions in 1922 and subsequently, and the advances in wage rates in the past three or four years, the reduction in the operating ratio, especially in transportation expenses, reflects credit upon operating management.

VIII. CHANGES IN RAILWAY NET INCOME

The Transportation Act of 1920 placed upon the Interstate Commerce Commission the duty of establishing rates so that the railways as a whole, or as a whole in territorial groups, under honest and efficient operation, may earn, "as nearly as may be," a fair return on the value of property held for and used in the service of transportation. Valuation was to be determined by the Commission according to procedure under way since 1914, and for the first two years the fair return was defined as 5½ per cent plus an additional one-half of 1 per cent, in the discretion of the commission, "to make provision in whole or in part for improvements, betterments, or equipment . . . chargeable to capital account."

The rate advances of 1920 were intended by the Commission to yield net railway operating income equal to 6 per cent on an aggregate value of $18,900,000,000. The Commission estimated that sum by applying to the railway total book costs the percentage which the Commission's tentative valuation of approximately one-quarter of the railways bore to the book costs of those properties. In effect, that method wrote down the railway book costs about 5 per cent.

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[26] In the first 10 months of 1928, the operating ratio was 72.64 per cent or 1.32 points of percentage less than in the corresponding period of 1927.

While the Commission's rate increase order was made with the intention of yielding 6 per cent on the estimated value, the actual return was less than one-half of 6 per cent, as the traffic and gross earnings of 1921 fell off sharply. It was hoped that with a revival of business the 1920 rates would yield the desired return in later years, but they have not done so. Since 1920, as has already been noted, freight rates as a whole have been reduced. In 1922, after the expiration of the two-year period in which the 6 per cent maximum return was contemplated, the Commission, acting under a provision of the law requiring it periodically to set the fair return to conform to changing conditions, found that the fair return from that time should be 5¾ per cent without any additional allowance for capital expenditures from income. No change has since been made. The law imposed upon the Commission the obligation in determining the rate of return to "give due consideration, among other things, to the transportation needs of the country and the necessity (under honest, efficient, and economical management of existing transportation facilities) of enlarging such facilities in order to provide the people of the United States with adequate transportation."

In the opinion of the Commission, a return of 5¾ per cent on value is adequate to serve the purpose which Congress had in mind, that is, to permit railways to earn, under honest and efficient management, sufficient net income to sustain their credit, and to obtain capital as needed on reasonable terms to enlarge facilities so as to furnish the public with adequate service. Yet in no year since the Transportation Act was passed have the railways as a whole earned as much as 5¾ per cent on value. The public, during the past four years, has been furnished with adequate rail service, largely as a result of capital expenditures devoted to enlargement of facilities and betterment of equipment, but these capital expenditures have been made in a hope, thus far unrealized, that the spirit of the law which promises a fair return would be carried out by the Commission. This is not to say that the low earning power of railways may be remedied entirely by rate increases, as higher rates might stifle business activity and further diminish railway net income, but the fact remains that the net return on the value of railway property has been plainly inadequate since 1920, and unless that return is bettered the carriers may be unable to continue to enlarge their facilities to keep pace with traffic demands. If that time comes, the people of the United States will not then be furnished with adequate transportation.

The Commission does not publish the annual return on valuation, and may not do so until their valuation work is complete. In the absence of the total official valuation figures from the Commission, the railway book costs may be taken, subject to the qualification that in 1920 they were roughly 5 per cent in excess of the tentative base then used by the Commission in the rate advance case. The rate of return annually from 1920 to 1927 is given in Table 19. The railway value includes working capital in cash and material and supplies, as well as the investment in road and equipment for Class I roads and their nonoperating subsidiaries. Net railway operating income is what is left out of operating revenues after payment of operating expenses, taxes, and net debit balances for joint facility rents and hire of equipment. It is the amount left to pay interest charges on funded and other debt, rentals for leased lines, other charges, and dividends—in other words, the net amount which may be considered as a reward to the total capital invested, and the basis which should be used in computing the rate of return on investment as a whole

TABLE 19.—NET RAILWAY OPERATING INCOME AND RETURN ON INVESTMENT, CLASS I RAILWAYS AND THEIR NONOPERATING SUBSIDIARIES, 1921 TO 1927

(In millions of dollars)

Year	Operating revenues	Operating expenses	Taxes	Net railway operating income	Railway property investment	Annual return on investment
						Per cent
1921	5,517	4,563	276	608	20,673	2.9
1922	5,559	4,415	301	760	20,911	3.6
1923	6,290	4,895	332	962	21,764	4.4
1924	5,921	4,508	340	974	22,564	4.3
1925	6,123	4,537	359	1,121	23,146	4.8
1926	6,383	4,669	389	1,213	23,455	5.2
1927	6,134	4,573	376	1,068	[a]23,716	4.5
First 10 months:						
1927	5,230	3,875	324	944	. .	[b]4.6
1928	5,152	3,712	325	985		[b]4.7

[a] Partially estimated

[b] Report of Bureau of Railway Economics

Even with a liberal allowance for the difference between the railway book cost and the valuation that the Interstate Commerce Commission may finally fix for rate-making purposes, the return in the seven years since the enactment of the new rule of rate making is markedly inadequate. For the seven years, the average return on the investment was but 4.3 per cent. The aggregate net railway operating income of the seven years was $2,277,000,000 less than 5¾ per cent on the investment, a deficiency of $325,000,000 per year.

The question may be asked: "Why have the railways continued, during the past three or four years, to invest such large additional sums when the return on the investment as a whole has been so meager?" An adequate answer requires consideration of the background of the present situation. When the extensive program of improvements was undertaken in 1922 and 1923, as a deliberate policy of the Association of Railway Executives, they had the more or less definite promise in the

Transportation Act that the railways, as a whole or regionally, would be permitted to earn a fair return. At that time the policy of the Interstate Commerce Commission in interpreting the new rule of rate making had not been developed, except initially in 1920, and there was abundant reason to hope, if not confidently to expect, that the mandate of Congress would be observed. In other words, the inadequate returns of 1922 and 1923 might have been regarded as merely transitional and one form of the pains of economic readjustment. Since then, the net income as a whole has been substantially below a fair return and the prospects of improving it are not encouraging, notably since the passage of the Hoch-Smith resolution which in effect directs the Commission to reduce rates on the commodities affected when there is evidence of a depression in an industry. While that resolution was intended specifically to afford preferential treatment to agricultural products, the Commission apparently is giving it broader interpretation, as in the Lake Cargo Case, when, because of a depression in the coal industry in the northern field, lower rates to lake ports were approved and the southern fields were not similarly favored. Reductions in rates under the Hoch-Smith resolution are to be made only when not inconsistent with existing law. The railroad net return as a whole is not consistent with the policy of the 1920 act, yet further rate reductions have been ordered and proposals to increase other rates have been held up.

One partial answer to the question may be that some of the fundamental issues of valuation and rate making are yet to be determined by the Supreme Court, and there is faith that a satisfactory solution will be found when that body speaks. Another partial answer is that the railways have faith in the ultimate fairness of the public and the Government, and hope for an eventual change in policy more favorable to the carriers. Such a change would not come about without public goodwill toward railways, and public goodwill could not be held without good service. To give good service, the additional facilities and better equipment are essential.

The most complete answer to the question lies, probably, in the fact that the additional capital expenditures were intended not only to provide adequate transportation but also to produce it more economically. The new capital, taken by itself, is probably earning more than a fair return in operating economies, even though the net income as a whole is less than a fair return on the entire investment. The return on the total investment might be even lower if the new capital were withheld. It is a case of investing additional money to protect the larger sums previously invested.

One effect of inadequate income has been to spur railway management to do its utmost in increasing efficiency and economy. The Commission is required to take these factors into account, and has broad powers to inquire into all phases of management. Except in a few singular cases, no criticism on that score has been voiced by the Commission. On the contrary, it has, by implication at least, given the railways as a whole a clean bill on economical management. The facts concerning recent improvements in operation indicate clearly that the Commission's present policy of holding down the rate scales cannot be born of belief that there is any general inefficiency or dishonesty in management.

As now organized financially, the railways as a whole have about 59 per cent of their capital structure in funded debt on which the average interest rate is now about 4.7 per cent. A return of 5¾ per cent on the property value would give enough income to pay the 4.7 per cent interest on the 59 per cent of capitalization in bonds and leave divisible income equivalent to 7.3 per cent dividend upon the 41 per cent of capitalization in stock, provided, of course, that the total capitalization were not greater than property value. As a matter of fact, the railway net capitalization is less than the book investment value. The total investment in road and equipment (all roads) in 1927 (not including working capital in cash and materials held for use) was $24,453,870,938. The gross capitalization was $23,614,325,858, but that capitalization included $5,477,634,413 in securities owned by the railways themselves, leaving a net capitalization of $18,136,691,445 in the hands of the public, a sum six billions less than the total investment in road and equipment.

Consideration must be given also to the fact that the net income from which dividends are declared comes not only from railroad operations but also from outside investments. In many cases these are substantial. Such investments are not included in the railway value (investment in road and equipment) upon which the fair return is computed, nor are the returns included in net railway operating income. Yet the income from outside investments is an addition to the railway income available for dividends on railway stock.

To these factors, which explain why the dividends recently paid upon railway stocks are higher than the rate of return on railway investment, may be added one additional factor. A substantial part of the total railway stocks have received no dividends for years. In 1927 the non-dividend stock was 30 per cent of the total. The proportion of such stock is decreasing. In 1921 it was 43 per cent.

Table 20 gives the dividend rates and the interest rates on funded debt, 1920 to 1927, inclusive. The average rate of interest is not reported by the Interstate Commerce Commission, but has been approximated here by taking the par value of outstanding funded debt and relating it to the actual interest payments on funded debt.

While the figures in Table 20 reflect fairly satisfactory dividend rates on dividend-paying stock, the rate on all stock (including the 30 per cent on which dividends were not paid) is not sufficient to justify investors

Table 20.—Dividends on Capital Stock and Interest Rate on Funded Debt, All Railways, 1920 to 1927, Inclusive

Year	Per cent of stock yielding dividends	Amount of stock yielding dividends	Amount of dividends declared	Average rate on dividend-yielding stock	Ratio of dividends declared to all stock	Average interest rate on funded debt
		Millions of dollars	*Millions of dollars*	*Per cent*	*Per cent*	*Per cent*
1920	57 30	5,075	331	6 52	3 74	[a]4 43
1921	56 92	5,060	[b]456	[b]9 02	[b]5 13	[a]4 68
1922	59 38	5,321	339	6 37	3 78	4 68
1923	62 09	5,646	412	7 30	4 53	4 61
1924	64 97	6,042	385	6 37	4.14	4 75
1925	66 70	6,279	410	6 52	4 35	4 74
1926	69 12	6,473	474	7 32	5 06	4 69
1927	70 25	6,701	567	8 47	5 95	4 74

[a] Class I railways only

[b] Increase over 1920 caused almost entirely by stock dividends

in risking additional capital in railway stocks except those of the strong companies.

The per cent of dividend-paying stocks has been increasing steadily since 1921. The 1927 per cent, 70.25, is the highest on record. The degree of insolvency (indicated by railway mileage in the hands of receivers) also has shown an improvement. In 1921, the mileage was 13,512, owned by 68 companies. In 1927, the mileage was 16,752, owned by 40 companies, but since then the Chicago, Milwaukee & St. Paul Railway (the only large system in the list) has been reorganized, and the receivers have been discharged. Deducting the mileage of that road from the 1927 total, leaves 6,569 miles, or about one-half of the 1921 total.

IX. CONSOLIDATION AND UNIFICATION

The Transportation Act of 1920 requires the Interstate Commerce Commission to prepare a plan for the consolidation of all railways into a limited number of systems, and the intent of the law is that such consolidations shall be brought about, so that, instead of many railroads of varying degrees of earning power and financial strength, there shall be but a few of fairly equal strength. It is provided that in such groupings competition shall be preserved as fully as practicable, and that the existing routes and channels of traffic shall not be unduly disturbed.

The Commission has followed the instructions of Congress up to the point of publishing its final plan. It has drafted and published its tentative plan, has held extended hearings, considered numerous proposals, and built up a voluminous record, but the final plan has not yet been formulated. In fact, its chairman in 1927 admitted, in hearings before Congressional committees on proposed amendments to the law, that the task is too difficult and that the Commission would like to be relieved of preparing a final plan. As an alternative, the Commission supports the proposal that consolidations, on correct principles and subject to its approval, should be allowed to take place naturally and voluntarily, as in the past, instead of an advance grand-scale determination of a comprehensive scheme to which all proposals must conform. The Parker Bill to permit such voluntary consolidations, subject to commission approval, came near to enactment in the spring of 1928, and is likely to be reintroduced in 1929.

As the matter now stands, no consolidation of railway properties may be made without Commission approval, and no proposal may be approved unless it is in harmony with the final plan which the Commission has not yet prepared. As a consequence, no consolidation has taken place since the 1920 law was passed, and none can take place until the final plan is published or the law is changed. There have been, however, a few so-called unifications by lease or stock control. The Commission is empowered to approve combinations short of actual consolidation, when in the public interest. Several proposals of that kind have been acted upon, and a few are now before the Commission. Until the present law is changed to permit piecemeal and voluntary consolidations, with adequate protection to the weak lines and the general public, little progress toward systematic consolidation can be made.

The principal object of consolidation is to simplify the problems of regional rate-making. As has already been mentioned, the law provides that rates shall be set for the railways as a whole in a territorial region, so that the railways in that region may earn a fair return on their aggregate value. The treatment is by groups, not by individual roads. Competitive freight rates in a region are necessarily the same on each competing road. Where distance class-rates apply in freight service, the mileage rate is uniform. Passenger mileage rates are, with few exceptions, the same on all roads in a region. If these uniform rates are determined by the income needs of all of the roads in a region considered as one system, it necessarily follows that the rates so determined will yield more than a fair return to the strong and less than a fair return to the weak. The real problem is the protection of the weak road. The strong roads are partially held in check by the recapture clause of the 1920 law, under which one-half of net income in excess of 6 per cent on value is taken by the Government, but no provision is made for compensating the poor roads which earn less than the fair return. If the number of roads in each region were reduced, the weak lines parceled out to the strong, and a new alignment perfected which would give approximately equal strength to each of the few large systems to be organized, then the uniform rate scales would yield approximately the same rate of return to each and the problem of the weak road would disappear.

While simplification of rate control may be regarded as the prime objective of consolidation, there are likely to be other advantages in unification of terminals, more efficient use of equipment and facilities, and economies of other kinds through elimination of duplication of effort. But these economies are likely to be overestimated, and in any specific case there will always be the possibility of diminution in competition and disturbance in transportation relationships between the many communities served. This explains why, as a general rule, the representatives of cities and the organizations of shippers are lukewarm toward, if not actually opposed to, the principle of consolidation.

We are here concerned only with economic changes since the war period. So far as consolidation of railway properties is concerned, a fundamental change was intended by the 1920 law, but, instead of accomplishing its purpose, the law has actually retarded consolidation on a large scale by acting as a brake on the natural process of system development by voluntary action, the process under which in earlier periods the existing large systems have grown.

X. CHANGES IN QUALITY OF RAILWAY SERVICE

The recent inprovement in the quality of railway service cannot be quantitatively measured. It cannot, like gains in operating efficiency, be expressed in definite units or percentages of change. The universal testimony of shippers and others interested in rail transportation is that, in the past three years and at present, the service is of a higher standard than ever before, and the recent railway record has been favorably commented upon by the Interstate Commerce Commission, the Secretary of Commerce, and others in high governmental positions. Secretary Hoover, in his 1927 annual report, estimated that the rapidity of freight transportation was then from 30 per cent to 40 per cent greater than at the close of the war, and expressed the view that the expedition of railway service has reacted favorably upon the entire economic structure.

Concretely, the improvement in service is seen in the relief from car shortages, in freedom from traffic congestion, in quicker movement of freight, and in closer adherence to scheduled transit times, thereby insuring dependability in delivery.

The credit for better service may be given to several factors already discussed. First in importance are the capital expenditures devoted to enlarging and improving facilities and equipment. These, with more effective managerial control and better employee morale, have increased the productivity of the plant. The improvement in service, however, would undoubtedly have been very much less had it not been for the cordial co-operation of shippers through their Regional Advisory Boards. These boards, the first organized early in 1923, consist entirely of purchasers of transportation and are now organized on a regional basis, 14 in all, with an aggregate membership of approximately 15,000, representing something like 25 million shippers and receivers of freight by rail. They meet regularly, with railway representatives as guests, and their committees dealing with specific commodities are constantly in touch with railway officers. This organized co-operative effort has resulted in a closer and more cordial and understanding relationship between the users and the producers of transportation. Car demands have been anticipated and provided for in advance; seasonal or unusual movements are planned for and transportation difficulties avoided; and the frequent contact in co-operative effort has given each side a more complete and sympathetic understanding of common and individual problems. It is probable that a large part of the credit for the better utilization of freight cars should go to the shippers' advisory boards, as well as to the better management of the railways.

In the effort to improve service, the railways have recently increased the number of scheduled fast freight trains, and have speeded up their movement so as to make earlier deliveries at destination. This has been accomplished in part by the greater use of the principle of making up trains to run through without dropping or picking up cars en route, by establishing longer locomotive runs, by reducing delays at interdivisional terminals, and by cutting down the time required at initial and final terminals in the making up of the train and the placing of the cars at destination. Distinct progress has been made in the operation of classification yards, and throughout the entire train yard and terminal service there is a new conception of the value of a minute.

The shipper of small lots of less-than-carload freight finds that a revision of transfer points has reduced the number of handlings, as well as the time in transit. Improvements in freight house facilities and operating methods have reduced the stand-by losses of trucks and drays. Amplification of car records and passing times are giving quicker and more complete information concerning shipments in transit. Greater pains are taken by the traffic and operating officers of the railways to merchandise railway service.

Besides the satisfaction of having prompt and reliable rail service, the typical manufacturer or merchant has discovered that because of transportation dependability he can realize real and substantial savings by carrying smaller stocks of raw materials, finished products, or merchandise. The reduction in credit demands, partial release of "frozen assets," saving in interest charges, and loss or deterioration in inventories, cannot be estimated with accuracy, but in the aggregate they run into large sums. For such savings the higher grade of railway service may be credited in substantial part. The improvement in transportation called attention to the possibilities, and gave impetus to the recent general improvement in inventory control.

One instance was cited by Secretary of Commerce Hoover, in an address on April 5, 1927, before the Atlantic States Shippers' Advisory Board, when he referred to the fact that principally because of better rail service the retail lumber dealers found that they could carry on their business with approximately four billion less board-feet in stocks than six years before, thereby releasing about $600,000,000 of capital in that one industry. He mentioned, further, that one of the reasons for the abundant capital in this country at the present time is the enormous decrease in inventories, not alone in lumber but in dry goods and in every commodity in the country. One of the reasons for stability in price levels is the fact that goods move quickly, and there is not the stimulus to rising prices and the pyramiding of orders that come about in the face of any suspension of ample transportation.

One further quotation from Mr. Hoover succinctly summarizes the topic. The following is taken from his 1926 annual report as Secretary of Commerce:

> Probably the most outstanding single industrial accomplishment since the war has been the reorganization of our American railways. Our transportation service was not only demoralized by Government operation during the war but had suffered chronic car shortages and insufficient service, not only after the war but for many years before. The annual loss from this periodic strangulation in transportation was estimated in the department's annual report of 1925 to amount to hundreds of millions a year. The insufficiency of transportation interfered with steady industrial operations, created intermittent employment, increased the cost of production, and, through periodic strangulation, caused high prices to the consumer. Manufacturers and distributors were compelled to carry excessive inventories as a protective measure, thus not only increasing the amount of capital required in the business but multiplying the danger of loss by price fluctuation.
>
> The railways, during the past five years, not only have built up adequate service and given complete correction to those ills, but they have, by great ability of their managers, greatly reduced transportation costs and thus made rate reductions possible which would not have been otherwise the case . . . The result of this great reorganization upon the whole economic fabric of the country has been far-reaching.

XI. SUMMARY

From 1920 (when railway property investment was slightly in excess of $20,000,000,000) to 1927, inclusive, the railways have made gross expenditures of nearly $6,000,000,000 for additions to and betterments of facilities and equipment, an average annual expenditure of three-quarters of a billion. Of the total sum, approximately one-half has been devoted to roadway and structures, principally in additional running tracks, sidings, and yards; improved terminals and structures; additional automatic and other signaling; heavier rail; more and better ties; and more and better ballast. The other one-half has been devoted to betterments of equipment. The number of equipment units shows little change—a slight increase in freight cars but actual decreases in locomotives and passenger cars—but the average and the aggregate capacity of the units have increased and, particularly in locomotives, there have been notable improvements in design and economic effectiveness. In the first few years of the postwar period, the expenditures for equipment were greater than those for roadway and structures, but during the latter part of the period the proportions have been reversed. Because of the more effective use of equipment, the additional traffic has been handled with the same or even less units, and orders for new locomotives and cars have been mainly for replacement of units retired.

A little less than one-quarter of the six billions devoted to additions and betterments has been charged to operating expenses or to the profit and loss surplus. Such charges, in the main, represent the original cost of property or equipment replaced or retired. Something more than two-thirds of the six billions was added to the investment account—the excess cost of the new over the original cost of the old. Less than one-fifth of the six billions has been capitalized by the issue of stocks or bonds. For the years 1920 to 1927, inclusive, the gross expenditures for additions and betterments were $5,978,296,000; the net increase in the investment account was $4,604,551,000; and the net increase in railway capitalization in stocks and bonds was $1,142,761,000. These figures indicate that the greater part of the gross expenditures for betterments and of the net increase in investment was financed from income or surplus and has not been capitalized. That conservative policy on the part of the railways was not altogether one of choice, but was made necessary by the practical inability of the typical railway to sell stock, and the high rates of interest or heavy discounts required to make the bonds marketable. An unhealthy tendency is apparent in the growing proportion of funded debt of total capitalization. The funded debt proportion grew from about 50 per cent in 1910 to 58 per cent in 1920, and to 59 per cent since 1923.

Railway freight traffic since 1920 has had a general (but slight) upward tendency. The ton-miles of 1923 and 1926 were of record-breaking volume. The former peak-loads were in 1918 and 1920. Taking 1918, a war year, as 100, the successive peaks were 101 in 1920, 102 in 1923 and 1925, 109 in 1926, and 106 in 1927. The number of loaded cars shows relatively greater increases than ton-miles, but the loaded car unit does not take into account the tendency toward a smaller carload. Railway passenger traffic, in contrast to the slight increase in freight, is steadily and seriously diminishing in volume. Since 1920, each year, with the exception of 1923, has had a smaller total passenger-miles than the preceding year. The passenger-miles in 1927 were 28 per cent less than in 1920. The loss is almost entirely in local passengers, and is owing mainly to motor vehicle competition. Long distance passengers and commuters have been increasing slightly.

The effect of motor truck competition on railways, while it has diminished the volume of less-than-carload freight and has taken away some tonnage in carload lots in a few other commodities, is not serious. Relatively, the freight lost to trucks is a small part of the total, and it is the least remunerative of railway freight. The small-shipment, short-haul freight traffic is burdensome in its demands upon equipment and facilities, and the railways are better off when the equipment and facility capacity, released by the loss of freight to trucks, is employed for the long-distance bulk-freight which is more attractive from the point of view of net revenue. In railway passenger service, however, the loss in local passengers to automobiles and motor coaches is substantial and serious, and is narrowing the already small spread between railway passenger revenues and passenger expenses. To meet the new form of competition, the railways are improving the schedules and equipment of the through trains, and are entering the motor coach field themselves by substituting motor transportation for branch-line trains or paralleling their rail lines by motor coach service. The greatest loss to the railways, however, is not in the passengers taken by motor coaches, but in the greater use of the private automobile as a substitute for railway transportation.

Shortly after the Transportation Act was passed in 1920, the Interstate Commerce Commission, acting under the new rule of rate-making, authorized rate increases which were intended to yield a 6 per cent return on railway property value. The average advance in freight rates was between 30 per cent and 35 per cent; in passenger service, the mileage rates were increased about 18 per cent and Pullman fares were advanced 50 per cent. These heavy increases did not, however, yield 6 per cent on property value, as the 1921 traffic fell off sharply. After the initial attempt to adjust rates so as to yield a specified rate of return, as required by law, the Commission apparently has given less attention to the relation between rates as a whole and fair return than to the downward adjustment of specific rates, notably on agricultural products. The average revenue per ton-mile in 1921 was 1.275 cents; in 1927, it was 1.080 cents. The ton-mile revenue is not always an accurate index of relative rates, but in this case it is indicative of reductions since 1921. These reductions, on the basis of the differences between the ton-mile revenue of 1921 and of subsequent years up to and including 1927, have saved the shipping public over $4,000,000,000, or at the rate of $670,000,000 per year. In passenger service, the rates have remained substantially the same since the advances of 1920, although, on the one hand, the tendency has been to offer to the public more opportunities in the form of reduced excursion or tourist rates, and, on the other hand, there have been advances in suburban fares in some localities. The revenue per passenger-mile has declined from 3.086 cents in 1921 to 2.896 cents in 1927, but the decrease has been the result not only of the greater use of excursion tickets, but also of higher proportions of through passengers and suburbanites, and of lower proportions of local passengers who travel on the highest passenger-mile rates.

When the railways were restored to private operation after the war, the employee morale, in common with employee morale in nearly all industries, was seriously impaired. Relations were further strained when the Railroad Labor Board reduced wages in 1921 and 1922, and took away certain favorable rules, and the service was adversely affected by a nation-wide strike of shopmen in 1922–23. The Railroad Labor Board, created by the 1920 law, did not function satisfactorily, and it was replaced in 1926 by a Board of Mediation. Since then, there have been no serious labor troubles, but friction has been avoided partly by wage advances by mutual agreement between management and employees, or as a result of mediation. The process of mediation as a substitute for the offices of the Railroad Labor Board (on which the public members held the deciding vote) has not yet been subjected to a severe test. The Labor Board was not successful in avoiding disputes, and mediation since 1926 has maintained peace. The average wages per hour and per year, while less than those of the war period, have been gradually increasing since 1923, and the employee morale has shown an improvement. Employees are co-operating effectively with management in increasing the efficiency of operation. The traffic units per man-hour were 17 per cent greater in 1926 than in 1920, and 10 per cent greater than in 1923, but the major part of the gain is attributable to improved facilities and equipment.

The most notable achievement in railroad administration since the war has been the marked increase in the efficiency with which equipment has been utilized and trains operated. The car-miles per car-day have been increased from 25.1 in 1920 to 30.3 in 1927, and the ton-miles per car-day from 498 to 518. The 11 per cent more ton-miles of 1926 (the high record), compared with 1920, were produced with but 2 per cent more freight cars, notwithstanding a smaller average carload (over which the railways have little control) and a larger percentage of empty car-miles resulting from centralized distribution in shifting surplus cars from one region to another as needed for prospective loading. Unserviceable freight cars and locomotives have been reduced materially in number. In train service, there has been a steady and consistent gain in the train load from year to year since 1920, with a similar consistent gain in train speed through a reduction in road delays. In 1920, the gross load per train (cars and contents) was 1,443 tons; in 1927 it was 1,780 tons, a gain of 24 per cent. In 1920, the average train speed between terminals was 10.3 miles per hour; in 1927, it was 12.3 miles per hour, an increase of 19 per cent. In the inclusive unit combining load and speed—

gross ton-miles per train-hour—the gain was from 14,876 to 21,945, an increase in efficiency of 48 per cent. This impressive gain in production per train-hour was not purchased at the expense of higher ton-mile cost, as the operating ratio for the service as a whole has been brought down from 82.7 per cent in 1920 to 74.6 per cent in 1927, notwithstanding rate reductions and losses in passenger traffic. The greater efficiency in fuel consumption stands out as a single item. The savings in coal in 1927, in comparison with 1920, were 19 per cent in freight service and 13 per cent in passenger service (on the basis of consumption per ton-mile and per car-mile, respectively), and were equivalent in train service alone to economies of $62,000,000 per year. Through better administration of material and supplies held for use in maintenance, operation, and construction, the savings in carrying charges in 1926, in comparison with 1920, were about $32,000,000.[27]

From the railway point of view, the only important unfavorable element in the present situation is the low net return on value. The 1920 law was intended by Congress to give the railways a reasonable assurance of a fair return, but the rate-making policy of the Interstate Commerce Commission has not been consistent with that intention. The Commission, effective in 1922, defined a fair return as 5¾ per cent on value, but in no year since the law was enacted in 1920 have the railways earned that return. The work of valuation of railroad property is not complete, and in its present stage is surrounded by many uncertainties which are yet to be cleared up by the Supreme Court, but it seems not at all unlikely that the final value, when determined, will be little different from the investment cost carried on the railway books. On that value, plus working capital in cash and materials held for use, the net return in operating income was 2.9 per cent in 1921, with a gradually increasing rate up to 4.8 per cent in 1925 and 5.2 per cent in 1926, the year of greatest freight traffic volume and greatest gross revenues. In 1927, with slightly less traffic, the return was but 4.5 per cent, and, for the first 10 months of 1928, it was at the rate of 4.7 per cent. The average for the seven years ended with 1927 was 4.3 per cent, a rate inadequate as a reward for taking the risks of investment, and plainly below the reward that Congress intended as an incentive to adequate transportation service to the public when the Transportation Act was passed. The additional investments of the past eight years have been made with faith in the assurance of a fair return. Although the fair return has not been earned upon the total investment, it is likely that it would have been even less without the additional investments, as they not only made it possible to produce the greater volume of transportation since 1923 but also to produce it at lower cost. There is a limit, however, to the extent to which new dollars can be devoted to saving old dollars already invested, and the present policy of betterments cannot long be continued on an average return of 4.3 per cent on the whole.

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[27] Lower prices in 1926 contributed substantially to this result.

Little progress has been made in carrying out the provisions of the Transportation Act pertaining to the consolidation of all railways into a limited number of systems of fairly equal financial strength. The purpose of that part of the Act was to simplify the problems of rate-making, and to insure reasonably uniform returns under uniform rates to all of the railways in any region. The Interstate Commerce Commission was directed to prepare a final plan to which all proposals should conform, but the Commission has reached the conclusion that the task is too difficult, and no final plan has been published. In the meantime, no consolidations can take place because, according to law, none can be approved unless it is in harmony with the Commission's final plan not yet prepared. All that can be done is to approve unifications by lease or stock control, but short of actual consolidation. A few such proposals have been approved and others are before the Commission, but the law instead of bringing about the intended large-scale consolidations has, because of the inability of the Commission to prepare a final plan, acted as a brake upon the long-time natural process under which the existing systems have grown. An amendment to the law, proposing a period in which consolidations, when believed by the Commission to be in the public interest, may be effected voluntarily without regard to a comprehensive plan, was favorably considered by Congress early in 1928, but was crowded off the calender in the closing days of the session.

From the public point of view, the outstanding railway development since the war has been the marked improvement in transportation service. The adequacy, speed, and dependability in freight movement have never been better. The improvement is seen in freedom from car shortages, embargoes, and other restrictions, and in close adherence to scheduled transit times. The number of scheduled fast freight trains has been increased and the speed bettered so as to give earlier deliveries at destination. Incidental services have been extended, and throughout the whole service there is greater effort to apply modern merchandising principles in the development and sale of transportation. The regularity of movement and dependability in rail service have given impetus to the general practice among manufacturers and merchants of carrying smaller inventories of raw materials and merchandise. Better rail service cannot be credited wholly with this economic development, but it called attention to the possibilities and led to the general movement. Certain it is that the smaller stocks would not afford adequate protection, were rail service less prompt and reliable. The general reductions in inventories have released sums of capital which in the aggregate are enormous, and in buying habits have brought about profound changes which are far-reaching in their economic effects.

PART 2.—SHIPPING

BY E. S. GREGG

The developments in our merchant shipping industry in the last five years are related to the following:

1. The gradual restoration of an approximate equilibrium between the world supply of ships, which had been greatly enlarged for war purposes, and the volume of ocean-borne commerce, which had been diminished by the dislocation of channels of trade and the exhaustion of productive effort in many countries;
2. The attempts to liquidate our own huge surplus of war-built and Government-owned ships; and
3. The phenomenal growth of water shipments between the Atlantic and Pacific Coasts by way of the Panama Canal.

Total Available Tonnage.—The world shipping industry has had to contend with the largest surplus of tonnage in its history. The ship tonnage of the world was 36 per cent greater in 1923 than in 1914.

TABLE. 1.—STEEL AND IRON STEAM AND MOTOR SHIPS (EXCLUDING LAKE TONNAGE), 100 GROSS TONS AND OVER

(Millions of gross tons as of June 30)

Country	1914	1923	1924	1925	1926	1927	1928
Great Britain and Ireland	18.9	19.1	18.9	19.3	19.2	19.2	19.7
British Dominion	1.4	2.2	2.2	2.2	2.3	2.3	2.4
United States	1.8	12.4	11.8	11.6	11.1	10.8	10.9
Italy	2.5	2.8	2.7	2.9	3.1	3.4	3.3
Germany	5.1	2.5	2.9	3.0	3.0	3.3	3.7
France	1.9	3.3	3.2	3.3	3.3	3.4	3.3
Holland	1.5	2.6	2.5	2.6	2.6	2.6	2.8
Scandinavia	3.7	4.3	4.4	4.8	5.0	5.1	5.4
Japan	1.6	3.4	3.7	3.7	3.8	3.9	4.0
Other	4.1	5.3	5.2	5.4	5.7	5.5	6.1
Total	42.5	57.9	57.5	58.8	59.1	59.5	61.6

No exact data on the volume of ocean-borne trade are available, but estimates in 1923 placed it at only about 80 to 85 per cent of prewar. With a third more ships and a fifth less cargo, the maladjustment of supply to demand was serious. A world-wide survey by the Department of Commerce showed 9,128,000 gross tons of ships idle in the ports of the world on January 1, 1923, or 16 per cent of the world total. The remarkable thing is that more tonnage was not out of active employment. This surplus has gradually been absorbed into trade or has been scrapped, and the latest figures show only 4,331,000 tons idle. Of this amount, over half will perhaps never be used regularly. The real surplus may now be said to be about 3 per cent, and this surplus is made up largely of types becoming rapidly obsolete and unusable. Statistics of world trade also indicate that the volume of ocean-borne commerce is now approximately at the level of 1913.

TABLE 2.—IDLE STEAM SHIPPING OF PRINCIPAL MARITIME COUNTRIES
(Thousands of gross tons as of January 1)

Country	1923	1924	1925	1926	1927	1928
Idle in home country:						
United States Shipping Board	4,411	3,564	3,664	3,518	2,336	2,371
Shipping Board tankers	214	163	125	134	56	41
Privately owned	703	541	417	458	457	544
Government owned other than Shipping Board	....	3	17	10	27	22
Total	5,328	4,271	4,225	4,120	2,876	2,978
United Kingdom	1,010	909	705	613	529	539
France	730	450	311	134	118	80
Italy	472	427	136	140	128	276
Netherlands	330	235	65	109	3	16
Norway	53	50	25	22	37	93
Sweden	22	.....	20	30	9	35
Greece	76	122	24	99	106	77
Japan	99	29	25	35	48	85
Belgium	170	86	26	21	14	1
Denmark	17	13	.....	63	20	26
Spain	520	128	60	44	35	31
Australia	106	85	166	51	71	29
Idle in foreign countries	195	83	103	279	100	65
Grand total	9,128	6,888	5,891	5,760	4,094	4,331

This large surplus of ships and the failure of the volume of the ocean-borne trade of the world to exceed prewar figures caused the profits of many cargo shipping companies to disappear entirely and of others to shrink almost to the vanishing point. The explanation is simple. Charter rates for voyages, that is, when a shipper charters a vessel for one or more specific voyages for a specified kind of cargo, were forced below the levels prevailing before the war. The *Economist* (London) index numbers of whole-cargo freights have been as shown in the following statement:

Average, 1913	100
December, 1923	112
December, 1924	111
December, 1925	105
December, 1926	127
December, 1927	102
January, 1928	98
February, 1928	94
March, 1928	93
April, 1928	95

The decline in these rates has been uninterrupted, except in 1926, when the British coal strike caused an unusual demand for tramp tonnage. Ship operating expenses have fluctuated between 50 and 100 per cent above prewar. While it is difficult to get a weighted index of ship operating expenses, such an index would perhaps be nearer 100 per cent above prewar than 50 per cent. The profits of most cargo shipping companies were ground to pieces between these two millstones.

All ocean shipping has not fared so badly. Recent studies show that approximately four-fifths of the transoceanic shipping of the world is operated on regular routes, as contrasted with less than two-thirds before the war. The picturesque tramp ship, roaming the seven seas for cargo, is disappearing.

As the volume of production and trade of commodities entering into ocean-borne commerce has increased, shipper and consignee have demanded faster and more regular services. The tendency toward a more level rate of general business operations has resulted in a marked smoothing out of the seasonal movement of agricultural commodities. It was the seasonal gluts of supplies to be moved that kept the tramp ship moving from one route to another. In the North Atlantic to-day practically all of the American wheat crop is carried in liners, and liners have taken from tramp ships most of the movement of cotton out of the Gulf. A cargo liner partly laden with miscellaneous high grade cargo is nearly always willing to fill out with wheat, cotton, or some other bulk commodity. Over most trade routes there is a large enough volume of general cargo moving to justify the use of ships on regular schedules. The result is that only unusual quantities of seasonal goods and some of the so-called "dirty" cargo, such as coal, now call for the use of tramp ships.

Liner companies, through conference rate agreements, are able partly to nullify the fierce competition which is normal in tramp shipping. Conference agreements between lines serving United States ports are legalized when these agreements are accepted by and filed with the Shipping Board. Our legislation recognizes the value of the stability achieved through conference agreements. The liner companies catering to passenger traffic have usually been able to earn more on their investment than straight cargo liner companies, and the last five years have been no exception in this respect. But in the passenger carrying trades and especially in the North Atlantic, the tendency in the last few years has been toward larger and faster ships, a costly competitive tendency which may, at least temporarily, reduce net earnings.

Shipbuilding.—The large growth in oversea bulk shipments of petroleum and its products has resulted in an increase of tanker tonnage, from 1,479,000 tons in 1914 to 5,161,000 tons in 1923 and a further increase to 6,544,000 tons in 1928. While most tanker tonnage is owned by the large oil companies, the independently owned tanker companies have fared better than shipping companies in general. It can be said, however, that ocean shipping on the average has had lean earnings since 1923.

This adverse earning situation necessarily reacted on the demand for new ships. The tonnage of steam vessels under construction in 1923 was only 2.5 million gross tons, as compared with a maximum world output of 6.8 million tons in 1919 and 3.2 million tons in 1913. By 1928 a slight improvement in demand for new tonnage had appeared. Over one-half of the shipping now on order, however, is to be equipped with Diesel engines, indicating a replacement of obsolete with more modern types; and over one-fifth of the total is tankers. The shipbuilding industry of the world is still in a depressed state.

TABLE 3.—STEAM AND MOTOR VESSELS UNDER CONSTRUCTION

(Thousands of gross tons as of June 30)

Country	1914	1923	1928
Great Britain and Ireland	1,718	1,337	1,203
Germany	546	301	408
Netherlands	113	99	173
Italy	65	141	154
France	226	170	126
Japan	91	72	111
United States	141	133	56
Other	228	286	429
Total	3,128	2,539	2,660

High operating expenses have furnished an urge to lower costs through improved mechanical efficiency. The rapid increase in motor-ship tonnage, from 234,000 tons in 1914 and 1,700,000 tons in 1923 to 5,153,000 tons in 1928, indicates how shipping executives have turned to the Diesel engine as an aid in reducing operating expenses. Steamers fitted for burning oil fuel have also greatly increased, from 1,300,000 tons in 1914 to 19,053,000 tons in 1928. The result has been that ships fitted for burning only coal now comprise 61 per cent of the world's total, as compared with 89 per cent in 1914. Recent tests with pulverized coal may again cause the trend to change. The demand in recent years has been for any type of prime mover which could be operated more cheaply than the older types.

American Merchant Marine.—Against this background of depression and low earnings, it is logical that American shipping has not prospered. It will be seen from Table 1 that American shipping has declined from 12.4 million tons in 1923 to 10 9 million tons in 1928, although world tonnage has been increasing in this period. A large part of this reduction has been due to scrapping, the Henry Ford project of breaking up 199 vessels of over half a million gross tons being the most ambitious, and part to sales abroad. It should further be noted that of the vessels registered under the American flag, 2,978,000 tons were idle on January 1, 1928.

One of the most important factors affecting our merchant marine in the last five years is political and, consequently, intangible and highly controversial. Fifty-eight per cent of the steam sea-going shipping of this country in 1923 was owned by the Government. The Shipping Board inherited about 2,000 ships planned for use in the war. Most of these ships were not finished until long after hostilities had ended. The wise course, as observers pointed out repeatedly in the years after the war, would have been to sell these ships for use or for scrapping at any price obtainable. From the political point of view, however, this proposal was extremely difficult, if not impossible, to carry out. As a result, the Shipping Board has been slow in disposing of its vessels, and has tended to operate as many lines as Congress has been willing to support.

Some progress, however, has been made in reducing the amount of Government-owned tonnage. Such tonnage comprised only 42 per cent of our merchant fleet at the beginning of 1928, as contrasted with 58 per cent five years earlier. Of the decline in Government owned tonnage amounting to 2,200,000 tons during this period, over three-quarters of a million tons were scrapped. The rest of the Government tonnage disposed of has found its way into active employment. The Shipping Board has sold all of its lines in the Pacific to private owners, and success is attending the efforts to dispose of the more important lines in the Atlantic

TABLE 4.—UNITED STATES SEA-GOING MERCHANT FLEET, 1,000 GROSS TONS AND OVER

(Thousands of tons, as of January 1)

	1923[a]	1924	1925	1926	1927	1928
Government-owned	6,544	6,318	6,109	5,507	4,563	4,337
Private	4,734	5,050	5,509	5,491	5,925	6,078
Total	11,278	11,368	11,168	10,998	10,488	10,415

[a] April 1; figure for January 1 not available.

trades. Even if the Board is successful in selling all of its lines, the problem of Government participation will not be entirely solved. Its large laid-up fleet will still be a potential threat to the rate market.

Belief that the Shipping Board may retire from shipping operations through sales to private owners has been strengthened by passage of the White-Jones Shipping Act early in 1928. This legislation provides for mail subventions on a fairly liberal scale and for Government loans on liberal terms to American shipping companies building vessels in American yards. The sale of Government lines operating to the West Coast of Africa, on terms that were better than the Board had been previously able to obtain, was made possible by this legislation. Mail subvention payments should also aid materially in the sale of the Shipping Board's transatlantic lines.

The great activity of the Shipping Board in starting new cargo services just after the war, coupled with the disorganization of foreign shipping services, resulted in 71 per cent of all imports and 38 per cent of all exports being carried in American vessels in 1921. These percentages dropped to 47 and 25 per cent, respectively, in 1926, the latest year for which these figures are available. A further analysis of the figures shows that 30 per cent of imports of dry cargo from oversea destinations was carried in American vessels in 1926 as compared with 44 per cent in 1921, and of exports of dry cargo to oversea destinations 21 per cent in 1926 was carried in American vessels as compared with 33 per cent in 1921. Our ships have made a better showing in the case of oil cargo. They brought in 76 per cent of our imports of petroleum in 1926 and carried out 31 per cent of our exports. No clear dependence of our trade on ships flying our flag is evident, since the volume of dry cargoes from oversea rose from 12,357,000 tons in 1921 to 26,189,000 in 1926, and of exports from 34,855,000 tons in 1921 to 46,914,000 tons in 1926.

At the present time, in only a few instances are Shipping Board lines competing directly with privately owned lines. The Board has withdrawn from the intercoastal trade, although it persists in selling ships to owners who intend to upset co-operative efforts toward rate stability in this trade. The Shipping Board's lack of willingness to scrap useless tonnage and its willingness to break out tied-up ships when rates rise, as in the case of the British coal strike in 1926, act as a drag on shipping rates.

It might be argued with some plausibility that a reserve of ships available for use in case of a temporary shortage of shipping is a stabilizing influence. No private enterprise could afford to have millions of dollars invested in idle ships which would be used perhaps only for two or three months every two or three years. In case of emergency these ships would be put into a trade to keep rates at a level only slightly in advance of what they were before the unusual circumstances arose. The income from the employment of these reserve ships during such an emergency would not begin to pay the fixed charges on the investment while these ships were idle. The Government has had idle ships and has used them on occasions to provide extra facilities on routes temporarily crowded with cargo. There is no sound economic argument for a continuance of this situation, if private initiative and enterprise are to be the guiding principles of our economic order.

Intercoastal Trade.—While the Panama Canal was opened to traffic in 1914, its effects on world trade did not begin to appear clearly until two or three years after the war. The influence of the canal on American shipping has been profound. The best of our privately owned merchant fleet deserted foreign trade routes and entered the protected trade between the Atlantic and Pacific coast. Foreign ships are forbidden to engage in our coastwise trade and the intercoastal trade is interpreted as being coastwise, although the trip is longer than most transoceanic ones. In spite of keen competition among intercoastal shipping lines, this business is more profitable than most foreign routes.

The heavy shipments of oil from California to the Gulf and Atlantic Coast, which, for several years, gave employment to a large part of the American tanker fleet, may not be permanent. On the other hand, it is probable that an increasing number of cargo ships will enter this service and, perhaps, even additional passenger ships.

TABLE 5.—GROSS TONNAGE OF UNITED STATES STEAMERS IN THE INTERCOASTAL TRADE, VIA THE PANAMA CANAL, BY TYPES, AS OF APRIL 1

Year	Passenger	Cargo	Tankers	Total
1923	28,775	764,043	675,074	1,367,892
1924	58,788	766,320	749,421	1,574,529
1925	84,374	747,234	429,314	1,260,922
1926	59,655	876,020	465,280	1,400,955
1927	59,655	841,539	412,859	1,313,853
1928	68,039	930,934	293,706	1,292,679

The significance of this shift in employment of privately owned American vessels extends in several directions:

1. Our ships in this service are not handicapped by competition with low-cost foreign ships and with seamen of lower standards of living. If the business is not profitable, ship owners engaged in it have only themselves to blame.

2. One argument for Government aid to our merchant marine has been that ships under our flag are necessary in case of war. Some of our finest ships are engaged in this protected trade. The amount of tonnage in this trade, which should continue to increase, apart from tankers, might constitute a naval reserve.

3. Replacements and additions to the tonnage in the intercoastal trade will provide a backbone of work for our shipyards, since only American-built vessels can engage in our coastwise trade.

These points all relate directly to our merchant shipping industry. The most far reaching influence, however, of this rapid growth of water shipments between the Atlantic and Pacific coast has been on channels of domestic trade and on the localization of industry in this country. While the ten million tons of freight shipped by water through the Panama Canal in a year is small in comparison with the billion and one-third tons of revenue freight originating on all our railways, and with the approximate quarter of a billion tons of transcontinental rail traffic, its influence has been out of proportion to the size of the movement. This is especially true when it is noted that 3,500,000 tons of the intercoastal trade is oil, and, of the dry cargo probably a substantial percentage was stimulated by the intercoastal services through the canal.

TABLE 6—VOLUME OF WATER-BORNE TRADE BETWEEN ATLANTIC, GULF, AND PACIFIC COASTS VIA THE PANAMA CANAL

Year	Eastbound	Westbound	Total
1924	7,883,797	2,195,756	10,079,553
1925	6,370,615	2,230,591	8,601,206
1926	7,523,944	2,572,705	10,096,649
1927	7,843,770	2,528,672	10,372,442

Cargo has been diverted from the transcontinental rail lines at a time when their earnings were low because of a variety of other reasons. It cannot logically be argued that intercoastal shipments were a large factor in the low earnings of these roads, but the diversion of traffic from railways to ships was unquestionably one factor.

The more significant influence of this movement has been to retard the localization of industries in certain sections of the Middle West. At the present time, a shipper on a line running north and south approximately through Cleveland, Ohio, can send goods to the Pacific Coast as cheaply by rail eastward and then by steamer westward through the Panama Canal as by rail westward. Shippers east of this imaginary line have lower transportation costs on west coast business, and new industries are likely to take this factor into account when they are about to locate a new plant.

The Middle West has thus been deprived of business which formerly fell to its lot. The recent action of the Illinois Central Railroad in publishing a joint rail and water tariff on steel articles originating around Chicago and destined for the Pacific Coast via the Gulf is an effort to recapture some of the freight which has been diverted to eastern mills whose location enabled them to use intercoastal ship service. It is too early as yet, however, to evaluate quantitatively the effect of this new policy.

This shift in channels of traffic has brought up the question of regulation of water rates in the intercoastal trade. The railroads which have lost this traffic are rigidly regulated by the Interstate Commerce Commission. The ocean shipping companies in the intercoastal trade have no restraints other than self-imposed ones. When intercoastal conference agreements have been broken and water rates lowered in the resulting cut-throat competition, the "watershed" has moved westward from Cleveland to the neighborhood of Chicago. Obviously, such disarrangements are harmful to everyone concerned. If the shipping executives in the intercoastal trade cannot stabilize their business through co-operative action, Government regulation, in the interest of the railroads and the shippers who suffer from quarrels among the shipping companies, may result. The working out of this problem, for which no exact precedent exists, will take time and even experimentation.

Inland Waterways.—The growth of business interest in our inland waterways, as a method of transportation supplementary to the agencies already existing, is due partly to the action of the Council of National Defense during the war. This Council recommended full utilization of our inland waterway facilities, which they believed would be of material benefit in the carriage of heavy traffic. The country was faced with war-time congestion, with little likelihood of better conditions in the near future; at the same time a constantly enlarging military program pointed to heavier traffic movements. While the immediate object of the Council's Committee on Inland Waterway Transportation was an organization of waterway traffic to meet war-time emergency, consideration was given to the future commercial value of various water routes, the development of which was recommended.

The principle of joint rail and inland water rates was established at this time. Without these joints tariffs and arrangements for interchange of cargo between rail and rivers, inland waterway carriers might still be limited to cargo originating within a few miles of the waterway, which was the situation prior to the appointment of the Committee on Inland Waterway Transportation of the Council of National Defense.

Part of the renewed interest in inland waterways is due to Mr. Hoover's insistence, while Secretary of Commerce, that our inland water transportation activities should be directed toward a unified and interchangeable system of 9,000 miles in the Mississippi and tributary valleys, and to a deep channel outlet from the Great Lakes to the Atlantic.

Also responsible for maintaining the interest of business men of the Middle West in this large program is the shift in traffic arising from the opening of the Panama Canal. Those affected by this shift are seeking cheaper transportation outlets and inlets, and therefore have been led to give support to the waterway services already in operation and to Congressional action for the appropriations necessary to unify the whole system.

In recent years, inland water transportation has increased steadily, although, as Table 7 shows, it is still a small percentage of the total volume of traffic carried by all means of transportation.

TABLE 7.—VOLUME OF TRAFFIC ON INLAND WATERWAYS

(In thousands of tons)

Item	1924	1925	1926
Tonnage originating on railways	1,287,000	1,351,000	1,440,000
Overseas foreign commerce	82,118	81,808	100,274
Great Lakes trade, eliminating trade between the United States and Canada	83,292	99,916	103,760
Trade between United States and Canada via Great Lakes	12,930	12,820	13,195
United States coastwise ocean-borne commerce (excluding Great Lakes and Panama Canal)	67,678	84,416	85,504
Total of navigable rivers and canals (excluding all known duplication)	173,190	204,569	217,000
River transportation in the United States (excluding transit tonnage of Detroit River)	102,432	118,294	127,421
Canal transportation in the United States	92,290	109,410	116,210
Sault Ste. Marie	72,037	81,875	85,679
Panama Canal (intercoastal traffic only)	11,327	9,460	10,922

Mississippi River inland waterway traffic has received more public attention than that of our other rivers because, in there experimenting with modern equipment, the Government is attempting to create conditions required to stimulate private operation on these waterways.

TABLE 8.—TONS OF TRAFFIC CARRIED BY MISSISSIPPI AND WARRIOR RIVER BARGE LINES, 1918–1927

Year	Mississippi service	Warrior service
1918	23,378	10,350
1919. . .	104,769	130,502
1920.. . . .	160,702	200,017
1921.	443,267	228,844
1922..	599,669	260,344
1923.	710,431	269,341
1924.	849,503	222,345
1925.............	910,755	231,464
1926............	1,044,649	296,929
1927. . .	1,237,452	398,694

When the deepening of the Mississippi and its tributaries is completed so that cargo can be continuously carried in large modern barges over the greater part of 9,000 miles of inland channels, the effectiveness of this method of transport—which is not new in our economic history—may be more clearly apparent.

The Government has borne the expense of the experimental stages of development, but if the inland waterways experiment by the Government proves a success, private capital will probably enter this field of transportation. A number of private corporations are now operating their own river transport facilities.

In recent years the project of a deep channel waterway from the Great Lakes to the Atlantic has been under consideration. The St. Lawrence and the New York State routes have been surveyed from the engineering and economic points. The conclusions of the United States St. Lawrence Commission favored the construction of a shipway from the Great Lakes to the sea for the relief and development of the interior of the continent. They favored a shipway on the St. Lawrence route, provided suitable agreement can be made with Canada for its joint undertaking. They were of the opinion that the development of the power resources of the St. Lawrence should be undertaken by associated agencies, and that negotiations should be entered into with Canada in an endeavor to arrive at an agreement on all of these subjects. Further conversations between the Canadian Government and our own have taken place without a definite line of united action having been decided upon.

Summary.—In the last five years, the world's shipping industry has had to contend with the worst surplus of tonnage in its history, and the decline in charter rates has been almost uninterrupted.

Not all ocean shipping has fared badly. The demand for faster and more regular service has favored the cargo liner, and the picturesque tramp is disappearing.

The adverse earning situation has reacted on the demand for new ships. At the same time high operating expenses have furnished an urge to lower costs through improved mechanical efficiency. Steamers fitted for burning oil fuel have greatly increased, and over half the shipping now on order is to be equipped with Diesel engines, indicating a replacement of obsolete with more modern types. However, the shipbuilding industry of the world is still depressed. American shipping has not been prosperous.

The effect of the Panama Canal on American shipping has been profound. The best of our privately owned merchant fleet is in the protected trade between the Atlantic and Pacific coasts. The canal has also influenced our channels of domestic trade and the localization of industry in this country.

The shifts in traffic due to the opening of the Panama Canal have caused business men in the Middle West to back the development of the Mississippi river system including a Great Lakes connection, and the Great Lakes to the Atlantic waterway.

CHAPTER V

MARKETING

BY MELVIN T. COPELAND

In the marketing field, the changes which have occurred since 1922 have been fully as notable as the changes in most other types of business activity, and of as great significance to the community. In order to keep the subject within manageable proportions for this survey, the topics selected for concentrated study, on the ground that they are of particular significance or of especial interest, are as follows: changes in demand, changes in retail trading areas, hand-to-mouth buying, changes in distribution, co-operative marketing, installment selling, and advertising.

As the facts brought out in the analyses of these various topics will show, there have been numerous cross-currents and counter-currents among the marketing influences at work. While these conflicting influences have benefited some industries and trades, they have reacted adversely upon other types of business. The purpose of this chapter is to show, so far as possible, the changes that have occurred and their relation to the general economic structure of the country.

I. CHANGES IN DEMAND

During the period since 1922, changes in demand have been one of the chief marketing developments.[1] As a consequence of the World War and of the boom preceding the crisis of 1920, various cakes-of-custom were broken. Old buying habits were changed and consumers subsequently manifested receptivity to new types of merchandise without all the customary delay and diffidence. New tastes and new buying habits developed more rapidly and more extensively than usually is the case under normal conditions. Wages did not decline at anything like the rate at which prices fell after 1920; consequently, buying power was available among large numbers of consumers to make the new demands effective. The merchandising imagination of some energetic manufacturers had been stimulated by the experiences of 1914 to 1920, with the result that they proceeded expeditiously to take advantage of consumers' receptivity. In numerous industries, furthermore, producing capacity was awaiting opportunity for utilization which furnished a strong incentive to the exercise of merchandising imagination. The changes in demand during the last ten years, therefore, arose broadly from the offerings of new types of products, of improved types of old products, changes in the tastes and desires of consumers, increased purchasing power, and changes in the "tempo" of living.

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[1] A detailed analysis of changes in standards of living, which constitute a major type of changes in demand, is given in Chap. I, Consumption and the Standard of Living.

These changes in demand brought business activity and prosperity to some industries and to some companies. They brought hardship and adversity to other industries or to individual companies. Any marked change in the quantity of merchandise of a particular sort that is desired, or in the character of the demand for the products of one industry, almost invariably has ramifications which are difficult to foresee and which are sometimes impossible to counteract. Herein is found one of the causes for the mixed conditions in American industry from 1922 to 1928, some industries manifesting great prosperity, others suffering from adversity.

New Commodities—Radio.—In the enumeration of changes in demand which occurred during the period covered by this survey, radio sets furnish the outstanding example of a new type of merchandise placed on the market with an almost phenomenally rapid increase in demand. The influences of this new medium of communication, furthermore, ramify widely. For the farmers, for example, the radio is not only furnishing news and crop information much more quickly than it hitherto has been available, but is also helping further to break down the differences between the wants and interests of the urban and the rural population. It is tending to make the market for various types of merchandise more homogeneous, since it increases the farmers' receptivity for, and even insistence on, merchandise similar to that bought by urban consumers.

A totally different quarter in which the radio is almost certain to exert an influence, of unforeseen significance, is in such districts as the lower East Side of New York City. On the roof of practically every tenement house on the lower East Side numerous radio antennae are in evidence, thus indicating that this new means of communication is already extensively installed in homes that so often have been looked upon as being somewhat impervious to the rapid spread of new ideas. The socializing influence and the possible effects of such a development on the standards of living of large numbers of consumers are subjects for interesting speculation.

The demand for radio sets spread within a few years from the homes of the well-to-do, through the middle-class urban community, to the farmers, in one direction, and to the homes of the tenement dwellers, in another. This spreading of demand resulted in a large volume of sales of radio equipment. Further than that, the use of radio equipment had an effect upon the demand for other types of commodities to which attention was called in radio broadcasting.

Airplanes.—Another new commodity which came to have commercial significance after 1920 was the airplane. By 1928, the volume of production of airplanes had not become sufficient to have a marked effect upon general business activity, nor had the influence of the airplane as a means of transportation then exerted a strong influence on commerce. Nevertheless, the industry was started during this period on a commercial basis and a demand was manifested for airplanes for commercial purposes not only for transportation of mail and the public conveyance of passengers, but also for private use by corporations in the conduct of their affairs.

Automobiles.—The period after 1920 also was marked by a rapid increase in the number of automobiles in use and by a change in the most popular type. In Table 1, data compiled by the National Automobile Chamber of Commerce are given on the annual production of closed and open cars from 1919 to 1927.

TABLE 1.—PRODUCTION OF CLOSED AND OPEN CARS,[a] UNITED STATES AND CANADA

Year	Open	Closed	Per cent closed
1919[b]	1,496,652	161,000	10.3
1920[b]	1,581,610	323,950	17.0
1921	1,191,220	337,945	22.1
1922	1,701,675	729,290	30.0
1923	2,481,404	1,278,300	34.0
1924	1,891,024	1,426,562	43.0
1925	1,694,774	2,201,258	56.5
1926	1,113,180	2,862,460	72.0
1927	530,795	2,555,223	82.8

[a] National Automobile Chamber of Commerce, *Facts and Figures of the Automobile Industry*, 1928, p 11

[b] United States only.

In 1922, 30 per cent of the cars produced were closed cars; in 1927, 82.8 per cent. In 1927, the number of closed cars produced was three and one-half times as great as in 1922, whereas the number of open cars produced had declined 69 per cent. This change in the demand for automobiles had a marked influence on the demand for various fabricating materials; for example, much larger quantities of plate glass were required for closed cars and a different sort of upholstery from that which commonly had been used in open cars.

The increased production of automobiles and the increased number in use does not tell the whole story of the effect of automobiles upon demand, because, with the increased number of closed cars in service and the improvement in roads, all-the-year-round use became far more common. The effect of this more constant use was to increase the demand for gasoline, lubricants, and tires, to provide an almost new market for alcohol, glycerine, and other nonfreezing preparations, and, not least, to increase the demand for labor for repair and maintenance service.

The year 1927 also brought a striking example of another change in the character of demand for automobiles. The experience which culminated in the closing of the Ford factory and in the announcement of the new model of the Ford car showed that consumers not only were interested in economical operation and utilitarian service of even the cheapest automobiles, but that they also desired greater comfort and more attractive appearance in the cars which they purchased. This manifestation of consumers' desires was in keeping with changes that were taking place in other industries.

Heating Equipment.—In homes and apartment houses the use of oil-burning furnaces was another significant development during the period under review, and the introduction of gas furnaces for home heating began. The increased use of oil-burning equipment not only affected the prosperity of companies manufacturing such equipment and that of the producers of fuel oil, but it had an adverse effect on the demand for anthracite coal. In the northeastern section of the United States, in fact, the increased use of oil-burning equipment spread sufficiently to place the anthracite coal producers on the defensive marketwise, probably for the first time since the mining of anthracite coal had become a large-scale commercial undertaking.

Electrical Appliances.—The increased use of electrical appliances was still another outstanding change in demand which occurred during the period after 1922. Table 2, which was compiled by *Electrical Merchandising*, a McGraw-Hill Co. publication, gives estimates of the retail sales of electrical appliances in 1922 and in 1927. The preparation of such estimates as these is obviously difficult and subject to some degree of error. Nevertheless, it probably is fair to conclude that the annual retail sales of electrical appliances for household use doubled in the period of six years from 1922 to 1927. Items for which the increase in the volume of estimated sales was greatest were electric refrigerators, clothes washers, and sewing machines.

Table 3, also prepared by *Electrical Merchandising*, gives an estimate of the total number of electrical appliances in use in January, 1923, and in January, 1928.

The data in Table 3 are noteworthy in comparison with the total number of wired homes—17,596,390. This comparison indicates that in 1928 a large percentage of the homes wired for electricity already had electric flatirons, that less than one-third of them had washing machines, that slightly over one-third had vacuum cleaners, and that less than 5 per cent had electrical refrigerators, despite the rapid rate of increase in sales of electrical refrigerators during the years immediately preceding.

The increased use of electrical appliances in the home shows partially the manner in which the servant problem had been met. With the curtailment of immigration and the demand for labor in other occupations,

TABLE 2.—SALES OF ELECTRICAL APPLIANCES

Appliance	Estimated retail sales	
	1922	1927
Clothes washers	$65,000,000	$118,500,000
Vacuum cleaners	40,000,000	49,344,000
Flatirons	20,000,000	14,250,000
Fans	11,000,000	11,250,000
Sewing machines	10,000,000	33,250,000
Ranges	8,000,000	17,600,000
Ranges, wall outlet		500,000
Ironing machines	6,000,000	10,880,000
Refrigerators	4,000,000	82,125,000
Radiators and heaters	3,300,000	2,475,000
Percolators	2,600,000	5,400,000
Violet ray outfits	2,500,000	2,250,000
Vibrators	2,000,000	1,150,000
Toasters	2,000,000	2,343,000
Heating pads	1,250,000	1,657,500
Dishwashers	750,000	1,440,000
Waffle irons	750,000	3,300,000
Grills, hot plates, and table stoves	875,000	1,890,000
Cookers (660 watts and under)	225,000	1,800,000
Total, 19 appliances	$178,250,000	$361,404,000

TABLE 3.—ELECTRICAL APPLIANCES IN USE

Appliance	January, 1923	January, 1928
Flatirons	7,000,000	15,300,000
Washing machines	2,915,000	5,000,000
Vacuum cleaners	3,850,000	6,828,000
Fans	3,500,000	4,900,000
Heaters	1,260,000	2,600,000
Toasters	1,000,000	4,540,000
Ironing machines	116,000	348,000
Refrigerators	27,000	755,000

the wages of servants were high and good service was difficult to secure. These conditions served to stimulate the demand for labor-saving equipment. Even in homes where servants were employed, the servants themselves often insisted upon being provided with these labor-saving devices as a condition of their service. The increased use of electrical appliances, moreover, not only helped solve the servant problem, but it also brought comfort and relief to many thousands of housewives who were not accustomed to employing servants. From a business standpoint, the sales of electrical appliances were a large factor in the prosperity of the companies manufacturing such goods and of related enterprises and public utility companies, but they reduced the sales of some other industries.

Most of the changes in demand which have been discussed so far have had to do with the introduction of new products or new types of products and the effects on industries whose markets were invaded. Another set of changes in demand, no less significant than those already cited, were those growing out of fashion.

Wearing Apparel.—There is nothing new in the phenomenon of changes of fashion, but the manifestations of the changes which have occurred during the last ten years have affected particular industries in a striking manner. The popularity of furs and fur-trimmed garments, short skirts, silk hosiery, and novelty styles of shoes resulted in activity in the silk hosiery industry, in the women's shoe trade, and in the fur business, but caused depression in the woolen and worsted industry and brought hardships to the manufacturers of cotton stockings. The woolen and worsted plants, equipped to manufacture enough cloth for ankle-length garments, had a substantial portion of their machines idle after the length of the skirts was raised to the knees. The popularity of fur trimming also tended to cut down the amount spent for cloth, since manufacturers and merchants sought to maintain the price of the finished garments at about the same figures that obtained before fur trimming came into vogue. A. D. Whiteside, president of the National Credit Office and later president of the Wool Institute, in an address before representatives of the wool industry, June 23, 1927, made the following statement regarding the relative value of materials entering into garments produced by manufacturers of women's cloaks and suits. This statement was a careful estimate based upon long and intimate acquaintance with the industry.

> For every $100 in fall and spring sales (by manufacturers of women's cloaks and suits in 1926), $30 was paid out for labor, general expense, and profit, leaving $70 for materials . . .
>
> In the spring, $39.20 of this remaining $70 went into furs, trimmings, and linings, leaving $30.80, or only three-tenths, against four-tenths for furs, of every $100 spent by women for spring apparel as the value of the woolen and worsted cloth in the average garment.
>
> But in the fall it was even worse, for during that season the cost of furs, trimmings, and linings amounted to $50.40 or one-half, leaving $19.60, or about one-fifth, of every $100 in sales as the value of the wool fabrics purchased by these cutters.

As a result of his analysis, Mr. Whiteside concluded that in 1927 the consumption of woolen and worsted fabrics amounted to approximately $656,000,000, as compared with a maximum manufacturing capacity in the industry of $1,750,000,000 at current prices. Under these circumstances it is small wonder that the woolen and worsted industry was not prosperous in 1925, 1926, and 1927.

The vogue for short skirts was accompanied by a widely prevalent demand for silk hosiery, and, to a less extent, for rayon hosiery. This demand cut down the market for cotton hosiery. One company, for example, which had had a long and successful career in the manufacture of cotton hosiery, has been liquidated since 1922 because it could not change its production facilities to make silk and rayon goods. Two other hosiery companies with similar records were continuing to operate in 1928, but with heavy losses. A fourth hosiery company whose embarrassment probably could be traced, in part at least, to the same fundamental cause, announced plans for reorganization in 1928. Numerous other manufacturers of cotton hosiery undoubtedly suffered similar hardships as a result of the shift in demand from cotton to silk and rayon stockings. The change came rapidly and affected nearly all classes of consumers. Some of the companies manufacturing silk hosiery, in contrast with those just referred to, were conspicuously prosperous during these years.

An effort to provide a full explanation of the changes in fashion would be largely a matter of speculation, for as yet no complete study has been made of the economic aspects of style merchandising.[2] The increase in the demand for silk hosiery can be accounted for, in part, by the prosperity of many classes of consumers, in part by the increased tempo of demand, and in part by a combination of style influences whose sources are subtle and not yet generally understood.

Reference has been made to the use of rayon for the manufacture of hosiery. Rayon, of course, was used before 1920 under the name of artificial silk, but the most rapid development of the industry occurred after that date. It was used not only for hosiery, but even more extensively for decorative purposes on cotton and wool fabrics; some fabrics also were made entirely of rayon. A notable change occurred in the increased use of rayon for women's underwear. In 1926 a survey was made, the results of which were published by the National Retail Dry Goods Association,[3] in which data were secured from representative department stores in all sections of the United States. This survey indicated that at that time 36 per cent of the sales of women's underwear (including vests, bloomers, step-ins, union suits, slips, and nightgowns) were made of rayon, 31 per cent of silk, and 33 per cent of cotton. The bulk of rayon underwear sold was of knitted construction, and the rapid shift of the demand from cotton to silk and rayon goods used for the manufacture of women's underwear had curtailed materially the demand for bleached cotton cloth for that use. This change in the type of fabrics used, together with the shorter skirts and the elimination of the old-fashioned petticoats, deprived cotton manufacturers of a market for a large yardage of bleached fabrics, thus tending to affect adversely the earnings of cotton mills producing fabrics previously used for that purpose.

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[2] For a pioneer study of certain aspects of this subject, see Paul H. Nystrom, *The Economics of Fashion,* New York, 1928.

[3] *Trend of Women's Underwear Sales,* National Retail Dry Goods Association, New York, 1927.

The foregoing examples by no means exhaust the list of those which might be recorded under the heading of changes in demand resulting from the spread of new fashions. They suffice, however, to suggest the widespread influence of those changes.

Other Industries.—Examples of changes in demand in various other industries during the last ten years are: the increased use of automobile accessories, such as motormeters and windshield wipers, the new demand for cigarette lighters and propeller pencils, the popularity of card matches, the more prevalent use of soft collars by men, the purchases of golf supplies, and the shift in the demand from the old-style timepieces to wrist and bracelet watches. In the industrial field occurred such changes as the introduction of new alloys, the development of a large market for busses, and the introduction of paint-spraying machinery, which afforded a new field of activity for certain manufacturers but threatened to impair the market for brushes and to become a competitor of the journeyman painters.[4] The increased use of paint-spraying machinery was closely related to the introduction of a new type of paint which presented an embarrassing problem to some of the old-line paint manufacturers. The manufacturers of ice-making machinery faced new problems as the result of the encroachments of electrical refrigerators. Numerous manufacturers of saddlery hardware have been forced by the increased use of automobiles and motor trucks either to change the character of their output or to go out of business.

More examples of similar tenor might be cited, but sufficient have been given, in this and other chapters of the survey, to indicate the prevalence of changes in demand within a short period of time. As a result of the rapidity of the changes and their character, some industries have been prosperous; others have been depressed. The changes came so rapidly, furthermore, as to prevent easy readjustment. The bulk of the output in many industries at the present time comes from large-scale, specializer plants which cannot be changed quickly and which have not heretofore maintained organizations which were prepared to cope without embaddrassment with swift changes in demand.

Merchandising.—The prevalent condition of changing demand and the spread of hand-to-mouth buying have put a premium on what is coming to be called "merchandising." Reductions in costs have been an important factor in enabling individual companies to meet price competition, and they have been of benefit to the community. In some industries the reductions in costs which have been made during the last ten years have been essential for the continued existence of particular companies. In many industries, nevertheless, reductions in costs have been of far less consequence than ingenuity in devising types and styles of merchandise which satisfied actual or potential demands of consumers.

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[4] See Mechanization, Chap. II, Industry, Part 1, p. 84; Part 2, p. 104; Chap. III, Construction, p. 234; Chap. VI, Labor, p. 483; Chap. VII, Management, p. 511; Chap. VIII, Agriculture, p. 557.

The manufacturers of gingham cloth, for example, could not have stemmed the trend of demand to fancy prints and other fabrics, even by large reductions in costs. The makers of women's black kid shoes no more could have competed successfully with novelty styles of shoes, merely by reducing costs, than the makers of the congress shoes for men a generation ago could have held their market by reducing prices. The competition of gas stoves with coal ranges has been governed by other factors than the costs of making ranges. The makers of the old-style timepieces, in the face of competition from wrist watches and bracelet watches, could not have insured prosperity for their enterprises merely by reducing costs. Without belittling the need for economy in production, the experience of recent years has especially emphasized the fact that the first requisite to success for an individual company or for an industry is to be able to cater effectively to the demands of consumers.

Many of the companies which have been most conspicuously successful during the last ten years have been the ones which have shown the most constructive merchandising ability. Conversely, the business troubles of numerous other companies can be traced to poor merchandising; that is, to the failures to comprehend market requirements, qualitatively and quantitatively.

A characteristic of many American industries during the nineteenth century and the early twentieth century was mass production of more or less standardized articles, a system which reached its zenith in the Ford plant. That method of operation permitted the economical utilization of labor and resulted in great economies in production. Since 1920, however, a different set of conditions has been apparent, as indicated by the new tempo of demand, the rapidity of style changes, and the receptivity of consumers to new varieties and types of products. Whether these new conditions are permanent or not, they must be faced. Some conditions, such as the change in rural markets and the rise in standards of living, are working for a continuance of frequently changing demand. There is some evidence of a reaction against widespread standardization of products, at least in the case of display merchandise. This tendency toward greater variety may be regretted, but it is a fact that cannot be disregarded by alert business executives. These conditions have placed a premium on keen foresight in product planning, that is, on constructive merchandising.

Merchandising[5] includes the determination of what goods to produce in order to meet actual or potential demands, what changes to make in existing products, what styles or finishes to provide for, what methods of packing to adopt, what products to discard, and what quantities to make. Henry S. Dennison, in a paper submitted at the annual meeting of the Taylor Society, in December, 1927, made the following statement regarding the experience of the Dennison Manufacturing Company:[6]

> Over a period of years, the task of merchandising has been found to consist of four elements. These are:
>
> 1. The study of the merchandise relative to—
>   (a) Creating new merchandise.
>   (b) Finding new uses for standard merchandise, and
>   (c) Watching the trends of the market, particularly to avoid the retaining of items that give indication of becoming obsolete.
> 2. The study of the merchandise relative to estimating the amount of production necessary to meet the market requirements at different seasons and periods.
> 3. The study of the merchandise relative to making price estimates on special merchandise and to making changes in list prices of stock merchandise.
> 4. To make each line of merchandise of continuing interest to the selling organization.

Until very recently, in most manufacturing companies this merchandising function has been assigned to various executives or shared jointly by numerous members of a manufacturing and sales organization. But within the last ten years, several companies have recognized the importance of this function and have set up in their organizations the office of merchandising manager, or its equivalent, to centralize the control of the merchandising function and to insure its proper performance. This probably has been one of the most noteworthy marketing developments during this period.

To sum up, the causes for changes in demand can be attributed, on the one hand, to the ingenuity of manufacturers in applying to ordinary uses new ideas, materials, and machinery which were developed during the war period, and to the devising of new products which rapidly attained popularity. The spread of the demand for many of these products was stimulated by the utilization of aggressive methods of marketing and sales promotion. On the other hand, the changes in demand were caused in part by the prevalence of high money wages, by the fact that the war and the subsequent boom had shaken many people loose from their old standards and made them receptive to new fashions and new notions. The modified economic conditions also placed a premium on the introduction of labor-saving devices. Thus, these changes in demand can be attributed partly to consumers and partly to the ingenuity of manufacturers and merchants in sensing the receptivity of consumers and in stimulating latent buying motives While these changes were occurring, some industries were prosperous and others unprofitable. Changes in demand, furthermore, presented new problems in organization and were accompanied by changes in buying habits, changes in methods of distribution, and utilization of intensive methods of sales promotion.

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[5] M. T. Copeland, "The Merchandising Function in Industrial Marketing," *Advertising and Selling*, November 16, 1927, p. 21.

[6] *Printers' Ink*, December 15, 1927, p. 109.

II. CHANGES IN RETAIL TRADING AREAS

In addition to changes in demand, modifications of the buying habits of large numbers of consumers have occurred since 1920 in a manner to disturb the established channels of distribution and to affect the economic life of numerous communities. The major change in buying habits has resulted in a widening of retail trading areas, particularly in rural sections of the United States. This change, like most of the other business developments noted, had begun prior to 1920, but its progress was markedly accelerated after that date.

Shifting of Trade.—The chief feature of this change was a shifting of trade in certain lines of merchandise away from crossroads stores, village stores, and some small town stores, to stores located at county seats or other trading centers. From the county seats and trading centers, some trade, particularly in dry goods and wearing apparel, shifted to the cities of, roughly, 25,000 to 100,000 population. These medium-size cities, in turn, lost some trade to the metropolitan markets, but the shift to metropolitan markets was less marked during this period than the changes at the smaller trading points.

Meanwhile, several countershifts of trade were taking place, such as a growth of suburban department stores near several large cities. In addition, a marked increase occurred in the number of roadside stands for selling fruit and vegetables or candy, soft drinks, and lunches, and in the number of scattered gasoline filling stations. These countershifts, however, were not so significant as the movement of trade to county seats and larger trading centers.

Almost no statistics have been collected on the change in retail trading areas, and, pending the completion of the Census of Distribution, not even an approximate measurement of the volume of trade involved is possible. Ample evidence has been found, nevertheless, to show that a change of major economic significance has been under way and to indicate the kinds of business most affected.

In the course of a survey of the distribution of textiles, made by the Harvard Bureau of Business Research in 1925, reference was made to a shifting of trade in dry goods away from general merchandise stores in small towns and rural villages to county seats and medium-size cities.[7]

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[7] Harvard University, Bureau of Business Research, *Bulletin* No. 56, "Distribution of Textiles," p. 149.

Professor Horace Secrist, in 1925, obtained information from 2,413 students in 26 universities regarding their practices in buying clothing and furnishings. He concluded that "the direction of the movement of trade is from the small to the large centers."[8]

The Committee on Business Research of the University of Nebraska in 1927 published a bulletin on retail trading areas in 27 counties in southern and southeastern Nebraska. From credit rating books, tables were compiled to show the number of stocks of different lines of goods carried by retailers in towns of different sizes in 1903, 1917, and 1925. That analysis indicated[9] that in 1925 there were fewer general merchandise stores, more grocery stores, little change in the number of stocks of meat, hardware, farm implements, or lumber, and a decrease in the number of harness shops, jewelry stocks, dry goods and women's apparel stocks, and shoe stocks. In most of the lines where decreases occurred, the changes were particularly marked after 1917. Information also was obtained from 171 students in the University of Nebraska regarding changes in the buying habits of their families, and one of the conclusions was stated as follows:[10]

> The towns with a population between 1,000 and 5,000 gain much trade from the smaller places, but it is true that the smaller towns of this class lose much trade to the larger places. Towns of under 5,000 population suffer the greatest loss with respect to men's dress goods, millinery, and women's ready-to-wear goods. Towns of over 5,000 population, the typical county-seat town, probably gain more trade than they lose, while Lincoln has especially gained from the development of roads and the wide distribution of the automobile.

The results of an inquiry regarding trade conditions in 45 villages in Illinois were published by the Bureau of Business Research of the University of Illinois in 1928. It was stated:[11] "Speaking generally, the sales of village merchants in Illinois have decreased, although this decrease seems to be much less than is popularly supposed."

The results of a study of conditions in a particular community were published in *The Drygoodsman* in 1925.[12] This study was concerned with the territory around Springfield, Ill. It gave evidence to indicate that in Athens, for example, a town with 1,241 population in 1921, located 14 miles north of Springfield, there had been a marked decrease in retail trade during the preceding four years. At Illiopolis, 24 miles east of Springfield and 16 miles west of Decatur, retail trade had declined greatly At Pawnee, 24 miles south of Springfield, retail trade had suffered less than in the other two outlying towns mentioned, but it was stated that there some sales had been lost to Springfield merchants.

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[8] Horace Secrist, *The Widening Retail Market*, A. W. Shaw Co., Chicago, 1926, p. 48.

[9] *Nebraska Studies in Business*, No. 18, "The Influence of Automobiles and Good Roads on Retail Trade Centers," pp. 7, 9.

[10] *Ibid*, p. 57.

[11] University of Illinois, Bureau of Business Research, *Bulletin* No. 19, "The Automobile and the Village Merchant," p. 7.

[12] Frank E. Belden, "Nationwide Trend Indicated by Study of Community with Good Roads," *The Drygoodsman and Southwest Merchant-Economist*, February 14, 1925, pp. 30–31.

The Research Department of the Curtis Publishing Co. recently made a survey of various trading areas, such as those centering at Galesburg, Ill.; Sioux City, Iowa; and Adrian, Mich. The results were analogous in each district. The Galesburg market, for instance, was stated to include three sections. The first, comprising an area extending 5 to 8 miles from Galesburg, included the population which made most of its purchases in Galesburg. The second, extending from 10 to 25 miles from Galesburg, was one in which consumers made a large part of their purchases of shopping goods in that city. The third section, more distant, was one in which consumers made only occasional purchases in Galesburg. The proprietor of a hardware and furniture store in a small town 10 miles from Galesburg was quoted as stating that his furniture business had dropped off 50 per cent by the shift of trade to Galesburg. The proprietor of a general merchandise store 25 miles from Galesburg stated that he had discontinued the sale of men's clothing, women's ready-to-wear clothing, and various other lines of merchandise, because of his inability to compete with the stores at the trading center. Similar statements by numerous other merchants were quoted.

An inquiry sent by the *Kansas Farmer* to merchants in cities of 10,000 to 40,000 population in Kansas, Nebraska, Missouri, and Oklahoma indicated that the merchants in those towns were increasing their sales to out-of-town customers.

In the *Commercial Survey of the Southeast*, by the United States Department of Commerce, in 1927, it was stated that the shift of trade from the country districts to the larger trading centers was common in all sections of the Southeast, the trading radii of some cities being 100 miles.[13]

The published evidence, summarized above, was, for this survey, supplemented by correspondence with 41 wholesalers, manufacturers, and publishers of trade papers and farm journals, and by personal interviews with bankers and other business men in various parts of the United States during the spring of 1928. Reports were obtained by this means on conditions in Pennsylvania, New York, Ohio, Michigan, Illinois, Iowa, Kansas, Minnesota, Oklahoma, Arkansas, Missouri, Tennessee, Georgia, Virginia, West Virginia, Alabama, Texas, California, Oregon, and Washington. Many of the correspondents were also acquainted, from experience, with conditions in various other states.

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[13] John M. Hager, *Commercial Survey of the Southeast*, United States Department of Commerce, Domestic Commerce Series No. 19, Washington, 1927, p. 179.

Space permits the presentation of excerpts from only a few of the pertinent statements received The editor of an especially progressive trade paper in the Middle West, for example, wrote as follows:

> The first tendencies were noticeable to us as far back as 1911. The shift in buying has been primarily in those lines which we roughly classify as fashion goods. In such merchandise the purchaser usually desires a greater variety and wider assortment than can be effectively offered by the small town store. To reach a point which does offer a satisfying assortment, we have discovered the average customer is willing to travel about one hour by any convenient means of transportation.

The editor of a trade paper in Kansas stated that it was not uncommon for people to drive 100 or 150 miles to cities such as Wichita, Hutchinson, Arkansas City, and Dodge City to shop, particularly for the purchase of style merchandise.

The secretary of a retail merchants' association on the Pacific Coast estimated that the number of small stores had been reduced by one-half within a radius of 100 miles of cities of 100,000 population or more. He thought that the more remote districts had not been so much affected.

Dry goods wholesalers in Virginia, Arkansas, Ohio, Illinois, Georgia, and West Virginia reported definitely that the sales of dry goods in small towns had fallen off and that there had been a decline in the number of country merchants handling them. One wholesaler gave this as the reason for the voluntary liquidation of his business, and another cited the same condition as having led him to start a chain of retail stores in trading centers.

A drug wholesaler testified as especially noticeable for the drug business:

> So far as the northwest territory is concerned, *i.e.*, the trade area served by the Minneapolis market which comprises Minnesota, North and South Dakota, Montana, northern Iowa, and western Wisconsin, I would say unhesitatingly that during the past five years small towns have suffered irreparable loss as a result of the shift of trade to the larger market towns, county seats, etc.

A firm selling cheap jewelry to stores in small towns reported more sales resistance during the past two years than in the three years previous. A man who is particularly well-informed regarding the retail clothing trade expressed his certainty that there had been a very considerable shift in trade in men's clothing away from the small towns to the county seats and larger cities. In the farm implement business a substantial decline, dating back to 1912, in the number of dealers was reported. In the grocery trade, on the other hand, the trading areas had undergone little change.

Much more evidence could be cited, but it would serve chiefly to corroborate the statements quoted. Practically all the reports agreed that a marked shift in retail trade in the small towns and rural districts and in the territories tributary to urban markets was taking place in certain lines of goods, and that this change had been especially accelerated since 1920

From the evidence, it is apparent that some lines of business have been much more affected by this change in trading areas than others. Those goods most affected were of the sort for which fashion dominates the demand, particularly women's apparel. It is for such goods that the trading area has the longest radius. There has been a marked tendency, however, for the trade in dry goods, toilet articles, jewelry, furniture, men's clothing, and shoes, to shift from general merchandise stores at crossroads or in small villages to the trading centers. The grocery trade has been much less affected. The retail agricultural implement business has been influenced not only by the general tendency for the shifting of trade to the larger trading centers, but also by a decline in the number of manufacturers of agricultural implements and by the increased sales of power machinery and heavy technical equipment, which requires upkeep service of greater proficiency than usually can be supplied by a small merchant.

This shift in trading areas has affected not only mercantile businesses, but also commercial banks. It has had some influence in lessening the deposits in small local banks, since their former depositors, to some extent, have preferred to do their banking in the trading centers where they do their shopping.

The development of the moving-picture business has been one of the causes for the shifting of trade, but it also has felt the effects. Accurate figures for the number of moving-picture theaters in the United States are available only for 1926, 1927, and 1928. In 1926 the total number of motion picture theaters was 14,976.[14] On March 1, 1927, the total number, according to a survey by the *Motion Picture News*,[15] was 15,119 and on March 1, 1928, the number was 14,235. An inquiry among men familiar with the business resulted in an estimate for the number of theaters in 1920 as 15,000. The tendency, therefore, seems to have been for a slight decline, particularly during the last year, in the number of moving-picture theaters. The theaters that were closed were chiefly small theaters in small towns, and their disappearance was much more than offset by the larger size of new theaters built. The *Motion Picture News* stated:[16]

> This disappearing group is composed almost entirely of the "shooting-gallery" type, which have passed their era of usefulness and are therefore giving place to the modern theater either in the same town or in the nearby natural trading center.
>
> The great increase in good roads and the use of the automobile is a decisive factor in the change that is going on.

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[14] J. S. Dickerson, *A Detailed Survey of Motion Picture Theaters in the United States.*

[15] *Motion Picture News*, April 14, 1928, p. 1197.

[16] *Ibid.*

The primary causes for the change in trading areas that has occurred have been the increased use of automobiles and the construction of good roads. These influences were supplemented by the popularity of moving pictures, in which the latest fashions were shown on the screen, and by radio broadcasting, which helped to stimulate an interest in new types of merchandise. Nearly all the influences which tended to cause changes in demand worked also toward increasing the size of retail trading areas, and various other influences also contributed to the modification of buying habits.

The spread of rural free delivery for mail, which has been facilitated by the building of good roads and the increased use of automobiles, removed one of the occasions which many farmers formerly had for visiting the local stores, and the discontinuance of fourth-class post offices took away one of the sources of income for numerous merchants. This was not a major cause for the change in trading areas, but, nevertheless, it probably was of some influence.

The figures in Table 4 were furnished by the United States Post Office Department and show the reduction in the number of fourth-class post offices.

The net reduction, by states, from July 1, 1919, to June 30, 1927, was as shown in Table 5.

In the South, the shift in trade during the last eight years has been influenced substantially by the decline in the amount of credit extended by lien merchants,[17] who made loans to the farmers on their growing crops. In the *Commercial Survey of the Southeast,* to which reference previously has been made, it was stated that since 1920 there had been a marked change in the South; for the farm-loan banks, intermediate credit banks, and local financial institutions in numerous instances had taken over the credit function which formerly had been performed so generally by the local storekeepers. This statement is supported by information from private sources. Although the change had begun prior to 1920, increasing freedom of the farmers from the lien merchants undoubtedly was one of the factors exerting an influence in the change in buying habits in the South during the recent period.

The increase in the size of trading areas basically has been merely a manifestation of certain inherent traits in human nature; namely, the desire for variety and for up-to-date styles. New means of transportation and communication made it possible for a larger number of consumers to gratify these desires.

Just as the canal, the railroad, the steamboat, the steamship, the telephone and telegraph, and the electric railways caused revolutionary changes in methods of carrying on trade, by new and swifter means of

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[17] John M. Hager, *Commercial Survey of the Southeast,* United States Department of Commerce, Domestic Commerce Series No. 19, Washington, 1927, pp. 176–177.

TABLE 4.—NET REDUCTION IN NUMBER OF FOURTH-CLASS POST OFFICES

Year ending July 1	Net reduction	Year ending July 1	Net reduction
1911	343	1919	1,261
1912	508	1920	574
1913	709	1921	460
1914	1,210	1922	220
1915	430	1923	333
1916	446	1924	347
1917	521	1925	308
1918	1,068	1926	367
		1927	336

TABLE 5.—NET REDUCTION IN NUMBER OF FOURTH-CLASS POST OFFICES, BY STATES, JULY 1, 1919 TO JUNE 30, 1927

States	Net reduction	States	Net reduction
Alabama	92	Montana	77
Alaska	[a]11	Nebraska	93
Arizona	1	Nevada	17
Arkansas	175	New Hampshire	21
California	18	New Jersey	42
Colorado	83	New Mexico	35
Connecticut	12	New York	122
Delaware	8	North Carolina	130
Florida	108	North Dakota	66
Georgia	78	Ohio	64
Idaho	54	Oklahoma	99
Illinois	70	Oregon	65
Indiana	74	Pennsylvania	201
Iowa	39	Rhode Island	17
Kansas	61	South Carolina	51
Kentucky	[a]126	South Dakota	39
Louisiana	131	Tennessee	41
Maine	51	Texas	98
Maryland	46	Utah	[a]7
Massachusetts	34	Vermont	15
Michigan	87	Virginia	111
Minnesota	45	Washington	70
Mississippi	151	West Virginia	33
Missouri	110	Wisconsin	61
		Wyoming	0

[a] Increase

transporting merchandise and passengers, so the automobile has been effecting a change in consumers' buying habits, particularly within the last ten years. The average trading area for consumers outside the urban districts has been increased by the automobile from 5 or 6 miles to 30 to 150 miles, and this change is still going on.

The size of retail trading areas has been affected in this latest development by the increase in the number of automobiles, in the mileage of hard-surfaced roads, and by the increased distances traveled by automobiles, all of which factors are interdependent.

Data are available to show definitely the increase in the number of automobiles and in the mileage of hard-surfaced roads. There are no adequate data, however, to show the increased distances traveled by automobiles. The number of automobile registrations by states is compiled annually by the National Automobile Chamber of Commerce. Data have also been compiled periodically by the Bureau of Public Roads of the United States Department of Agriculture on the mileage of surfaced roads.

From the Department of Agriculture's figures for the total road mileage and the mileage of surfaced roads,[18] the percentage of miles surfaced to total road mileage, including both state highways and county and local highways, has been computed for each state for selected years. From the data on passenger car registrations[19] and from the Census figures of 1920 and subsequent estimates of population by the Bureau of the Census, the number of passenger car registrations per 1,000 population has been computed for each state. In Table 6 these data are arranged according to the rank of the various states in the number of registrations per 1,000 population in 1925.[20]

Table 6 indicates that the increase in the number of passenger car registrations per 1,000 population exerted a greater influence than the increase in the mileage of hard-surfaced roads toward widening the radii of trading areas. It is to be noted, for example, that Iowa, Kansas, and Nebraska ranked high in the number of passenger car registrations per 1,000 population, but low in percentage of roads surfaced. Nevertheless, the statements that were received from business men and publishers acquainted with conditions in those states indicated that the shift in trading areas had been going on there nearly as rapidly as in other states with a high percentage of roads surfaced. As the mileage of good roads increases in the states which now have a low ratio, however, a further shift of trade is to be expected.

In examining Table 6, an interesting comparison of a rough sort is to be noted between three different sections of the country. With occasional

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[18] The figures for 1921 are from the United States Department of Agriculture, *Bulletin* No. 1279, "Rural Highway Mileage Income and Expenditures, 1921 and 1922," Washington, 1925, p. 20.

In the same bulletin, similar data are given also for 1904, 1909, and 1914. The figures for later years are from unpublished reports of the Department of Agriculture.

In one instance a misprint in the bulletin has been corrected. The percentage of roads surfaced for Oklahoma in 1921 was stated in the bulletin as 18.33 per cent. An examination of the actual figures indicates that the percentage should have been given as 1.83 per cent.

[19] National Automobile Chamber of Commerce, *Facts and Figures of the Automobile Industry*, 1927 and 1928 editions.

[20] In this table the figures for passenger car registrations for 1920 were used rather than those for 1921, because 1920 was the census year and the population figures for that year were not influenced in any way by estimates.

TABLE 6.—PASSENGER CAR REGISTRATIONS AND SURFACED ROADS, BY STATES

State	Passenger car registrations (per 1,000 population)			Percentage of roads surfaced		
	1920	1925	1927	1921	1925	1926
California	160	284	334	18.81	22.73	25.81
Iowa	170	253	268	2.48	5.82	9.00
Nevada	125	235	265	0.64	5.40	6.13
Oregon	117	227	251	17.70	21.62	22.38
Kansas	154	226	245	0.86	2.50	1.94
South Dakota	177	226	220	0.47	2.57	2.96
Nebraska	154	220	245	0.57	2.90	3.48
Colorado	129	213	228	9.55	12.68	9.14
North Dakota	137	209	226	0.67	1.68	1.75
Michigan	100	207	222	22.22	27.84	26.78
Indiana	102	204	221	52.27	65.81	67.16
Minnesota	126	201	210	15.78	22.56	27.23
Florida	66	188	244	23.29	32.48	42.87
Wisconsin	105	186	209	25.09	35.86	29.51
Wyoming	110	186	189	0.95	1.95	2.85
Vermont	82	183	208	24.15	31.04	29.86
Washington	106	183	209	26.33	35.24	35.27
Ohio	93	182	205	42.83	44.73	49.91
District of Columbia	67	175	182	..	...	. .
Oklahoma	101	171	184	1.83	1.26	2.40
Texas	81	170	185	8.88	12.34	12.03
New Hampshire	68	160	183	12.22	13.99	18.57
Utah	83	157	155	11.04	13.34	11.22
Missouri	79	156	174	7.06	9.60	10.01
Illinois	78	155	172	11.91	15.81	17.34
Maine	72	148	168	13.75	20.60	21.09
Idaho	108	145	171	9.59	34.22	21.10
Maryland	60	142	166	24.80	30.82	31.71
Arizona	89	140	174	5.81	14.15	14.26
Delaware	73	137	157	11.39	20.62	23.30
Connecticut	69	136	146	18.15	19.55	23.77
Massachusetts	58	134	145	34.85	41.34	43.36
New Jersey	65	130	156	45.92	42.93	47.02
New Mexico	57	124	147	3.95	5.05	4.07
Rhode Island	68	124	140	33.15	32.72	35.46
Montana	108	122	133	2.74	1.77	3.74
New York	51	121	142	22.68	32.06	33.90
Pennsylvania	60	121	139	15.30	20.31	25.78
West Virginia	48	116	128	3.89	4.62	8.73
North Carolina	50	111	135	24.57	29.62	37.59
Virginia	44	99	113	12.29	16.51	17.66
Kentucky	41	94	101	22.47	25.08	24.87
Louisiana	37	93	112	6.96	13.02	24.56
Tennessee	39	91	108	15.79	21.39	17.81
Mississippi	36	89	110	10.82	17.66	19.93
Arkansas	30	85	91	5.17	8.68	8.05
South Carolina	51	85	97	11.17	15.57	22.25
Alabama	26	70	83	17.84	22.03	27.69
Georgia	46	70	83	19.32	19.11	11.72

exceptions, the states with the highest number of passenger car registrations per 1,000 population are the agricultural states of the Middle West, the Northwest, and the Pacific Coast, some of which have a high percentage of roads surfaced, and some a low percentage. In the industrial states of the East, the ratio of the number of passenger cars per 1,000 population is substantially lower than in many of the agricultural states, but the mileage of good roads usually is high. In the southeastern and south central states, with the exception of Florida, the number of passenger car registrations per 1,000 population is lower than in the rest of the country, but the mileage of good roads has shown a marked increase since 1920. The number of cars per 1,000 population, furthermore, has shown the most rapid rate of increase since 1920 in the southern states, with the result that rural stores in the South have felt the force of long-distance competition as keenly as it has been felt by country merchants elsewhere in the United States.

The possibilities for further developments in the utilization of the automobile which may have an effect upon retail trading areas are suggested by the data given in Table 6. The number of passenger car registrations per 1,000 population ranged, in 1925, from 70 in Alabama and Georgia to 253 in Iowa and 284 in California. The percentage of roads surfaced in 1925 ranged from 1.26 per cent in Oklahoma to 65.81 per cent in Indiana. Although these percentages changed notably from year to year, the new means of transportation evidently had by no means reached its highest development, and therefore the changes in retail trading areas may be expected to continue.

The effects of the changes in retail trading areas have been varied and far-reaching. Apparently some decline occurred in the number of crossroads and village stores, particularly in the South. In the smaller towns, those merchants who have remained have been experiencing a change in the character of their business; they now commonly sell chiefly groceries and a few other staples; the trade in articles of wearing apparel, dry goods, shoes, furniture, and several other lines has been tending to pass out of the country store.

Several publishers of journals circulating among small town retailers, and also several wholesalers and association executives, expressed the view in their correspondence that the keen, wide-awake merchant in a small town could hold his trade, and they cited examples to prove their point. As a matter of fact, however, there are few keen, wide-awake merchants outside the trading centers, and, with the changed conditions, it has become harder for a merchant to operate a store successfully in those lines in which the trade is tending to shift to the county seats and larger cities than it is to succeed in the cities toward which trade is tending. There does not seem to be much likelihood that the country merchants will be able to exert a forceful influence in checking the shift.

At the county seats and other towns which have become trading centers, there apparently has been a tendency toward increasing specialization among the retailers. The general merchandise store has tended to become either a grocery store or a small department store in which groceries are pushed into the background. There seems to be an increased number of stores at such points specializing in the sale of clothing, shoes, or some other single line of merchandise. In the cities of medium size the merchants have been experiencing an influx of trade which has benefited particularly the stores selling the cheaper grades of merchandise. The demand for the better grades of wearing apparel, in such cities, however, has tended to remain stationary or, in some instances, to shift to still larger trading centers.

The tendency for retail trade to concentrate in a smaller number of trading centers has afforded an opportunity for chain store development. A chain store company which could not profitably extend its operation to country villages may be able to reach a large part of the rural population by having stores located in a relatively small number of trading centers. The greatest development in this direction probably still remains to be experienced.

The same influences which have tended to cause this shift in trading areas have been working also against the sale of merchandise by mail and may be taken as a reason for the recent moves by Sears, Roebuck & Co. and Montgomery Ward Co. to open chains of retail stores. In some instances, the opening of retail stores by the mail order houses seems to be accelerating the shift in trading areas. In an article by Eagle Freshwater,[21] an example was cited, which was said to be typical, of the experience of a furniture retailer in a town in Ohio—Fostoria—in which he stated that since the opening of a Montgomery Ward Co. store in that town a year before, he had sold more furniture and to customers from a greater distance than previously. He stated that people came from 50 to 75 or 80 miles away to shop in Fostoria.

One of the branches of industry most seriously affected by the change in trading areas is wholesale trade. During the last five years there have been several bankruptcies, liquidations, and mergers of dry goods wholesalers for which the change in trading areas has been one of the major causes. There also are a few examples of wholesalers who have decided to open chain stores as a means of meeting new conditions. As was indicated by the statements of several dry goods wholesalers, from whom information was secured on this change of market conditions, dry goods wholesalers typically have found that their markets in small towns have been seriously interfered with. The average dry goods wholesaler is selling smaller quantities of merchandise in the smaller towns, and if he continues to cover the same territory as he covered before the change began, his expenses have kept up while sales in such territories have declined. The stores in the trading centers he serves, furthermore, have become more easily accessible to other wholesalers, and competition for their patronage has become keener. The dry goods wholesaler, therefore, has found it difficult in many instances to operate economically the organization which was needed prior to ten years ago for serving the small town trade. This change in trading areas is one of the numerous causes for the predicament in which many wholesalers find themselves.

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[21] *Printers' Ink*, May 17, 1928, p. 73.

The drug wholesalers apparently have been having somewhat the same experience as the dry goods wholesalers, with the additional complication of the spread of chain stores in urban districts. The wholesale grocers have been affected less by the shift in trading areas than most other wholesalers, and they have been less embarrassed by this change than by the spread of chain stores.

Relatively few wholesale firms have as yet readjusted their methods for dealing with the new conditions. This tardiness in recognizing the significance of the shift and in adjusting operating methods to it is one of the major reasons for the unsettled conditions which prevail in various wholesale trades.

The shift in trading areas affects the sales plans of some manufacturers and the merchandise plans of others. Several manufacturers of shoes, for instance, who sell their products directly to retailers, have changed their salesmen's territories so that the salesmen call in fewer towns than they did ten years ago. It appears that the saving in traveling expense, however, has been offset, in most instances at least, by having the salesmen call more frequently in the towns and cities which remain on their lists. There the influence of hand-to-mouth buying has been manifested.

The change in trading areas, as has been pointed out, is closely related to changes in demand. Consumers who go to larger towns to shop and to visit the motion picture theaters have opportunities to view the latest styles and to observe displays of up-to-date merchandise generally. The results are that there is a cumulative increase in the demand for fashion goods and that the influence of style changes is rapidly felt throughout a large part of the buying public. There has been a lessening in the lag in the spread of new styles from the metropolitan districts to the rural communities. As a result, there has been a tendency for the demand for staple types of merchandise, such as standard cotton prints, to weaken, and those manufacturers who were making such staple goods in large volume for rural and small town trade are finding it necessary to change their methods of operation to meet the new conditions. The change in trading areas has facilitated the introduction of new types of merchandise by making it possible to reach consumers more expeditiously in the small towns and rural communities. Changes in demand have been accelerated, to the disadvantage, in some cases, of the sales of established industries. Hence the modification of consumers' buying habits, as manifested in changes in trading areas, has had mixed effects on business generally, aiding in the prosperity of some merchants and manufacturers while hampering others.

III. HAND-TO-MOUTH BUYING

After the crisis of 1920 it became common practice in various industries for buyers to order relatively small quantities of merchandise for immediate delivery, instead of placing large orders several months in advance of the required delivery dates. With an improvement in railroad transportation service after 1923, manufacturers in various industries reduced their inventories of materials and supplies, and scheduled their purchases so that materials delivered went immediately into production. These practices became popularly known as hand-to-mouth buying. They were still prevalent in 1928. The initial cause for hand-to-mouth buying during this period was the drop in prices that resulted from the crisis. Subsequent causes were the intensification of style influences, the application of new methods of inventory control, improved transportation conditions, the existence of excess producing capacity, and the competitive practices in certain industries. The effects of hand-to-mouth buying were shown in changes in inventory investments, in methods of warehousing, in production plans and methods, and in selling methods.

Whether hand-to-mouth buying was a more common practice from 1922 to 1928 than it had been at any time prior to 1920, and whether it represented a permanent change in methods of carrying on trade, are open questions. The fact can easily be established, however, that hand-to-mouth buying after 1920 was not an entirely new phenomenon in American business. In a trade report on the dry goods business in 1872, for example, it was stated:[22]

> The current purchases of the retail trade are confined to their limited requirements, and unless prices become settled on a lower basis there is every prospect that trade will be carried on from "hand-to-mouth" during the entire season.

Again, in 1874, regarding the same trade, it was reported:[23]

> Indeed this system of buying goods only as they are required is being practiced more generally by all classes of buyers, and although much the safer plan, it seems unsatisfactory to many of our merchants who became accustomed years ago to this rush of a short season during which buyers purchased their supplies for a half-year's trade. Now the season is prolonged, and the business is dragged through several months.

In 1896 we again find that buyers were "adhering to a hand-to-mouth policy in their purchases."[24] Similar statements appeared during various other years from 1870 to 1912, not only for dry goods but for groceries, flour, paint, shoes, and hardware In May, 1914, for instance, a market report on the hardware trade stated:[25]

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[22] *Commercial and Financial Chronicle*, New York, August 10, 1872, p. 195.

[23] *Ibid.*, August 29, 1874, p. 231.

[24] *Ibid.*, September 5, 1896, p. 414.

> At present, trade is eccentric and spasmodic, advancing and receding day by day, according to consumptive demand. The closely pruned small orders are still being given to travelers or transmitted direct by mail in the same tiresome fashion that has long prevailed.

In the trade in silk goods, hand-to-mouth buying had become a practice before 1913.[26]

The major causes for hand-to-mouth buying prior to 1920 were price uncertainties and, in the case of such merchandise as silk goods, the frequency of style changes. The same causes were primarily responsible for hand-to-mouth buying during the recent period. A conclusion regarding the probable persistence of the practice of hand-to-mouth buying is dependent, therefore, on the opinions that are held regarding the future course of prices and the continued influence of seasonal styles in merchandising.

When an attempt is made to secure definite measurements of the changes in buying practices which are known as hand-to-mouth buying, serious difficulties are encountered, because few manufacturing or mercantile firms have kept records which reveal changes in the size of orders over a period of years or which show changes in the volume of advance orders received. The evidence summarized in the following paragraphs, therefore, is unavoidably of a miscellaneous character, in many instances far from satisfactory, but the best that was discovered.

Unfilled Orders.—One means of securing an indication of the extent to which changes have occurred in advance ordering is by a comparison of changes in the average monthly unfilled orders with changes in the volume of business handled. In Table 7, such a comparison is given for various industries for which data are published in the *Survey of Current Business*. The comparison is by means of relatives based on 1922 figures taken as 100. If there had been no change in a particular industry in the practice of advance ordering, then the relatives for unfilled orders in that industry would have risen or declined by the same amount that the relatives for the volume of business changed. When the relatives for unfilled orders increased more rapidly than those for the volume of business, relative increase in advance orders was indicated. When the relatives for unfilled orders increased less rapidly or fell more rapidly than those for the volume of business, an increase in hand-to-mouth buying was indicated.

For finished cotton goods there was a slight decline in forward buying in 1923 as compared with 1922, and a sharp change in 1924. From 1924

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[25] *Hardware Age*, May 21, 1914, p. 82.

[26] James Chittick, *Silk Manufacturing and Its Problems*, New York, 1913, pp. 284–288.

TABLE 7.—MONTHLY AVERAGE OF UNFILLED ORDERS[a] COMPARED WITH VOLUME OF BUSINESS

(1922 = 100)

Industries	1922	1923	1924	1925	1926	1927
Finished cotton goods.						
Billings	100	101	83	84	86	90
Unfilled orders	100	96	60	59	62	59
Knit underwear.						
Production	100	112	106	110	98	102
Unfilled orders	100	127	82	100	73	79
Steel sheets:						
Production	100	117	115	154	150	143
Unfilled orders	100	130	106	153	153	130
Steel barrels:						
Shipments	100	116	102	131	143	143
Unfilled orders	100	155	114	176	217	194
Pumps, steam, power, and centrifugal						
Shipments	100	110	100	111	124	112
Unfilled orders	100	117	27	58	71	70
Bath tubs, enameled:						
Shipments	100	121	128	148	133	123
Unfilled orders	100	185	123	76	52	30
Western pine lumber.						
Production	100	121	114	125	119	108
Unfilled orders	100	86	94	85	82	81
Maple flooring:						
Production	100	102	75	77	81	82
Unfilled orders	100	132	61	50	52	46
Oak flooring:						
Production	100	132	152	189	194	165
Unfilled orders	100	134	141	157	126	109
Walnut lumber.[b]						
Production	...	100	139	151	109	117
Unfilled orders	...	100	134	174	178	176
Household furniture and case goods.						
Shipments	100	127	124	153	171	168
Unfilled orders	100	125	103	118	142	120
Furniture—Grand Rapids:[b]						
Shipments		100	100	108	108	100
Unfilled orders		[c]100	92	98	102	73
Piano stools and benches.						
Shipments	100	150	128	134	121	97
Unfilled orders	100	168	72	62	58	41
Face brick:						
Production	100	117	113	122	122	126
Unfilled orders	100	145	111	112	117	108
Paving brick.[b]						
Production		[d]100	78	88	72	73
Unfilled orders		[d]100	82	73	74	73
Illuminating glassware stock:[b]						
Production	..	100	77	84	78	72
Unfilled orders	..	100	81	72	44	38

[a] Computed from data published in *Survey of Current Business*, Washington. [b] 1923 = 100. [c] Seven months' average. [d] Nine months' average.

to 1927, the unfilled orders showed a monthly average which was about 60 per cent of the 1922 figures, whereas billings did not decline to anything like the same degree.

For knit underwear there was an increase in advance ordering in 1923 which substantially exceeded the increase in the rate of production, but in that industry, too, a marked change in advance ordering occurred in 1924, and after that date more hand-to-mouth buying evidently was practised.

In the steel sheet business, in contrast to the textile trades just cited, no persistent modification of buying practice took place. There was a more rapid increase in unfilled orders than in production in 1923, and a more rapid decline in 1927, but neither of those changes can be taken as having had more than temporary significance.

In the steel barrel business, unfilled orders increased much more rapidly than shipments in 1923, fell off less in 1924, and increased more rapidly in subsequent years. From these figures there appears to have been a tendency toward less hand-to-mouth buying of steel barrels.

For steam, power, and centrifugal pumps, enameled bath tubs, western pine lumber, maple flooring, oak flooring, household furniture, piano stools and benches, face brick, and illuminating glassware the data on unfilled orders indicate an increase in hand-to-mouth buying. For walnut lumber, however, the tendency evidently was toward more advance buying; and in the paving brick industry, unfilled orders fluctuated at about the same rate as production.

From a consideration of the unfilled order statistics of volume of business indexes for the foregoing group of miscellaneous industries, it appears that hand-to-mouth buying became more common after 1923 in a majority of the industries, but to varying degrees. Some industries showed little change, however, in their buying practices and in a few the tendency was toward more rather than less advance ordering.

A similar set of relatives (Table 8) has been computed for the monthly unfilled orders and shipments of the United States Steel Corporation.

TABLE 8—UNITED STATES STEEL CORPORATION RELATIVES FOR MONTHLY AVERAGE UNFILLED ORDERS AND SHIPMENTS

(Monthly averages 1922 = 100)

	1922	1923	1924	1925	1926	1927
Shipments	100	119	94	114	122	108
Unfilled orders	100	106	71	77	69	60

From the figures in Table 8 it is apparent that in the steel industry there was a tendency toward more hand-to-mouth buying.

The foregoing indexes of changes in unfilled orders and of the volume of business handled in various industries were computed from data available in published sources. In order to supplement those published data, information also was secured from numerous individual companies.

In the textile industry the evidence was conclusive that the manufacturers were not receiving large orders substantially in advance of delivery dates so commonly as they did prior to 1917, and the demand for prompt delivery was more insistent in 1927 and 1928 than in 1923 and 1924. One company manufacturing sheeting, for example, stated: "Our orders to-day cover only four to six weeks' requirements, whereas in 1913 they covered four months' requirements." Another company, manufacturing a popular, trade-marked cotton fabric, furnished records which showed that in 1923, 20.1 per cent of its orders were booked for delivery within one month from date of order; in 1927, 43.9 per cent. In 1923, 21.7 per cent of the orders were for delivery during the following month; in 1927, 31.8 per cent. Thus, on 58.2 per cent of this company's orders, deliveries could be made in more than two months in 1923, but in 1927 on only 24.3 per cent. For a well-known brand of gingham, 32 per cent of the orders were for delivery "at once" in 1924; 55.5 per cent in 1927; on 6.8 per cent, delivery was to be in one to four weeks in 1924; on 12.3 per cent in 1927. A cotton cloth converter reported that, in 1922, 13.6 per cent of his sales were on advance orders; in 1923, 16.8 per cent; in 1924, 10 per cent; in 1925, 4.4 per cent; and in 1926, 3.2 per cent. Although conditions varied, from company to company and from fabric to fabric, the evidence just cited was supported by nonstatistical statements of other cotton manufacturers that a marked decline in advance ordering of finished cotton fabrics occurred from 1923 to 1928. In the silk and worsted industries there also was an increase in hand-to-mouth buying.

In the shoe trade, as in the textile industry, hand-to-mouth buying became more common after 1920. A particularly good measurement of the change in buying practices was secured from the records of a large company manufacturing men's and women's shoes which were not of the ultrafashionable sort. These figures (Table 9) showed the percentage of the year's orders booked from one to four months in advance in 1916–17 and in 1927. It was stated by the company that the 1916–17 figures were typical for the entire period from 1912 to 1918.

This company obtained 52 per cent of its orders at least two months in advance of required delivery dates in 1916–17; and 2 per cent in 1927. It received 65 per cent of its orders at least one month in advance in 1916–17; and 18 per cent in 1927. That the experience of this company was fairly representative of the shoe trade was indicated by statements obtained from other shoe manufacturers. The only notable exception was in the case of women's novelty shoes where buying, prior to 1920, was of an entirely hand-to-mouth character.

In addition to the industries which have been cited, others in which there was a decline in forward buying were the tanning, hardware, household paint, and canned goods industries. The tanners of upper

TABLE 9.—ADVANCE ORDERS RECEIVED BY A SHOE MANUFACTURING COMPANY

(In per cent of year's net shipments)

	1916	1927
Booked for spring shipment starting December 1	*Per cent*	*Per cent*
4 months in advance	8	..
3 months in advance	18	.
2 months in advance	28	1
1 month in advance.	34	5
	1917	
Booked for fall shipment starting May 1:		
4 months in advance	1	.
3 months in advance	13	.
2 months in advance	24	1
1 month in advance	31	3
	1916–17	
Total regular advance bookings for year		
4 months in advance	9	..
3 months in advance	31	..
2 months in advance	52	2
1 month in advance	65	8

leather felt the effects of hand-to-mouth buying by shoe retailers, which led shoe manufacturers to curtail their forward buying. In the hardware industry, one company manufacturing a large variety of products stated that it employed 15 salesmen in 1913, 23 in 1923, and 27 in 1927; salesmen called on their customers two to three times a year in 1913, four to five times in 1923, and four to seven times in 1927; the customers ordered twelve weeks' requirements ordinarily in 1913, about eight in 1923, and four to six in 1927; the average size order was $40 in 1913, $23 in 1923, and $24 in 1927. This probably is a typical example of the extent of hand-to-mouth buying in numerous industries.

The foregoing furnishes some clues to the changes in advance ordering that have occurred in several important industries. For numerous other industries it was not possible, to obtain data on changes in buying practices, and for others only general statements could be secured. In the women's garment industry prior to 1917, orders usually were placed for delivery immediately or within a few weeks, and the same practice has continued since 1922. In the trade in perishable food products it always has been necessary to place orders for immediate delivery, and consequently no change occurred there. Manufacturers of such products as cement, newsprint, packing boxes, paper mill machinery, and machine tools reported little change in buying methods in their businesses; sales on contract or on special orders were customary both before and after 1922. In the men's clothing industry, in contrast to women's wear, a small decline in forward ordering and some increase in mail orders were reported by manufacturers, but in that industry in 1928 it still was customary for retailers to place the bulk of their orders with manufacturers several months in advance of delivery dates.

Among wholesalers, conditions varied from trade to trade, just as in manufacturing businesses. In the wholesale grocery business, the sales, as well as the purchases, of canned goods futures were tending to decline from 1922 to 1928. As the sale of advertised goods in packages increased, wholesalers tended to buy regularly in smaller quantities rather than speculatively in large lots. Here the influence of advertising and merchandising developments was felt. The sales of many items by wholesale grocers long had been on a hand-to-mouth basis. In the wholesale drug business, competitive conditions had led retailers long before 1922 to purchase chiefly in small units for immediate delivery; that practice continued after 1922. In the wholesale dry goods trade, a decline in forward ordering was reported, together with a decline in the size of the average order. The records of one specialty dry goods wholesale firm showed that in 1912 its advance orders amounted to 10.3 per cent of its sales for the year; in 1913, 12.4 per cent; in 1922, 5.4 per cent; in 1923, 7.7 per cent; in 1924, 4.7 per cent; and in 1927, 1.8 per cent. These figures very likely are roughly typical of the experience of other dry goods wholesalers. It is to be noted that while a substantial decline in the percentage of advance orders occurred, nevertheless, even in 1912–13, only 10 to 12 per cent of the sales were on advance orders, whereas at that time it was customary for dry goods wholesalers to place advance orders for a much larger percentage of their own annual purchases. Since 1922, many dry goods wholesalers probably have cut down their advance purchases more rapidly than their advance sales have declined.

Although the specific information available on hand-to-mouth buying is scanty and miscellaneous in character, it is apparent, nevertheless, that only a portion of the industries in the United States have been affected. Hand-to-mouth buying has not by any means become a universal practice, and in those industries affected, the degree of change was much greater in some industries than in others.

The effects of hand-to-mouth buying have been to change production conditions and methods in certain industries and to modify sales methods. In some instances the production peaks of manufacturers are said to have been leveled, while in others the irregularity of operations has been increased as a consequence of the lack of forward orders. In several industries in which the decline in advance ordering has been most pronounced, operating methods have been altered in order to permit speedier production. In the tanning industry, for example, several tanners of upper leather have ceased manufacturing for stock. Instead of finishing the leather prior to the receipt of orders, they put it through the tanning process and hold it "in pickle" or "in the crust," so that it can be finished quickly for delivery as orders are received. Shoe manufacturers have been enabled, as a result of the introduction of new types of machinery and changes in methods, to reduce production time. One shoe company manufacturing men's shoes, for example, stated that in 1925 it took 19 days for an order to go through the factory; in 1928, 12 days. In most manufacturing industries affected by hand-to-mouth buying, efforts have been made, with varying degrees of success, to counteract some of the disadvantages of a decline in advance orders by speeding up the production processes.

The decline in advance ordering has made it necessary for many manufacturers and wholesalers to send their salesmen over their territories more frequently than they did prior to 1922. In the shoe business it formerly was customary for each salesman to cover his territory twice a year. Now it is the general practice for each salesman to visit his customers four to six times a year. One dry goods wholesaler stated that formerly his salesmen made five or six trips a year; in 1928, eight to ten trips. Another dry goods wholesaler formerly had each salesman make four trips, but in 1928 the number was eight to twelve trips, varying between territories. One of the chief effects of hand-to-mouth buying thus has been to increase the number of salesmen employed and the frequency with which they call on their customers. In addition to this extra selling effort, many department stores have adopted the practice of sending buyers to the primary markets much more frequently than they did prior to 1922, thus increasing their buying expense.

New Methods of Inventory Control.—In order to meet the demands for prompt delivery, some manufacturers have opened branch warehouses at which stocks of finished goods are carried for immediate delivery. Other manufacturers have utilized public warehouses for the same purpose.[27] Such action has tended to increase the inventories carried by those manufacturers. For wholesalers and retailers, hand-to-mouth buying is supposed popularly to have led to a reduction in inventories, but in many cases the decrease in the size of the stocks of individual items has been largely, if not wholly, counterbalanced by the increase in the number of items carried—the result of changes in demand.

Reference has been made to the improvements in railroad transportation service[28] after 1923 which have enabled numerous manufacturers to schedule their purchases so that shipments of materials can be received daily as needed, without reliance on large reserve stocks. Several large automobile manufacturing companies, for example, are reported to have reduced their inventories of materials substantially after they became able to depend upon punctual deliveries by the railroads. Rehandling costs also were cut by having the materials enter into production immediately upon arrival. On one of the western divisions of a large railroad company there is a large steel plant which ships the greater part of its output to Detroit for use in the manufacture of automobiles. The steel is loaded into cars during the night and leaves the plant at 10 o'clock the following morning. The morning after that, it is delivered in Detroit. As a result of this service, it is stated, the automobile manufacturers have been able to eliminate this commodity from their stock and to depend entirely on current deliveries. When larger shipments of steel are required than the normal schedule calls for, extra steel frequently is shipped in passenger trains, by express, in order to protect the production schedules of the automobile manufacturers.

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[27] See H. A. Haring, *Warehousing*, New York, 1925, pp. 96–103.

[28] For a comprehensive analysis of the major changes in transportation service, see Chap. IV, Transportation, Part I.

As another example of some of the changes in transportation service which have occurred, the following information was received from one of the largest railroad companies in the United States. This company's lines serve many large manufacturing districts. During the year ended June 30, 1928, the schedules on 154 regularly scheduled less-than-carload merchandise cars were advanced by this company as follows: 46 cars advanced from second morning to first morning delivery; 68 cars from third morning to second morning delivery; 36 cars from fourth morning to third morning delivery; and 4 cars from fifth morning to fourth morning delivery. These changes were in continuation of a policy that the company had been following for several years. Even with the speeding up of schedules, the company succeeded in maintaining its schedules more effectively than before. In the last eight months of 1925, 88 per cent of its regularly scheduled less-than-carload merchandise cars arrived at destination on time; in 1926, 86 per cent; in 1927, 92 per cent; and in the first nine months of 1928, 93.6 per cent. The percentage of such cars arriving and unloaded on time was 69.3 per cent in the last eight months of 1925; 77.8 per cent in 1926; 84 per cent in 1927; and 86 per cent in the first nine months of 1928.

Another railroad company reported, in 1928, to the same effect:

> Freight train schedules are hooked up one with another looking toward minimization of terminal delay, distances being reckoned in hours and minutes rather than in miles. For instance, merchandise loaded in New York to-day arrives in Chicago early the fourth morning thereafter. It is given special movement by the eastern carriers through Chicago terminals and delivery effected to our line within an hour or two after arrival. We have a switch engine waiting to receive it and make a special run to our outer yard, Chicago, where a fast train is being made up leaving Chicago at 8:30 A. M. That train has a schedule of 23 hours to Kansas City, a distance of 458 miles, in a territory in which passenger train schedules are approximately 12 hours. The train arrives at Kansas City at 7:30 P. M., and freight for Kansas, Oklahoma, Colorado, and Texas is switched out of the through train and into trains scheduled to depart from Kansas City 30 minutes to 2 hours and 30 minutes thereafter. These trains arrive at such points as Tulsa, Oklahoma; Topeka, Kansas; Wichita, Kansas; and Hutchinson, Kansas, 600 to 700 miles away, for second morning delivery from Chicago.

That is practically express service; it was unheard of until recently, and, naturally, with such service there is no reason why the merchant should carry excessive stocks on his shelves, and he has simply shifted his burden on to the wholesaler and he, to a large extent, on to the manufacturer.

Many other instances could be cited of increased scheduling of freight trains, improvement in maintenance of schedules, reduction of time in transit, greater use of freight concentration points, improvements in through and pooled car service for less-than-carload shipments, and other means of expediting movement of freight and of rendering transportation service more dependable. The net effect of these changes must have been to reduce substantially the quantity of merchandise in transit at any one time, in proportion to the total quantity handled, just as the speeding up of production in a manufacturing plant reduces the stock of goods "in process." These improvements in transportation service also have enabled manufacturers to schedule their purchases so as to reduce inventories and cut handling costs.

In order to make a test of the effect of hand-to-mouth buying on merchandise inventories, statistics on inventories and sales of several hundred companies have been compiled from published and unpublished balance sheets and operating statements. These statistics are summarized in the following tables. The scope of these tabulations was limited by the fact that relatively few companies in most industries have reported both sales and inventory figures annually over a period of years, and the reports of only those companies that had reported both items each year were usable. It was not possible within the time available to obtain monthly inventory data; the tabulations were restricted to annual merchandise inventories as reported on balance sheets. Prewar comparisons would have been highly valuable for the interpretation of these data, but too few companies gave comparable information for prewar years to permit of such comparisons. Because of the small size of the sample for several of the industries, no attempt at precise comparisons between industries is warranted when examining these tabulations. They serve merely as the most comprehensive picture which could be drawn from existing material on relative changes in inventories and sales.

In Table 10 relatives are given for annual sales and inventories of groups of retail firms from 1922 to 1927.[29] These figures do not show

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[29] The aggregate sales of these groups of retail firms in 1927 were as follows: unit grocery stores, $2,248,000; grocery chains, $824,966,000; unit shoe stores, $3,616,000; shoe chains, $35,485,000; cigar chains (1926), $125,758,000; variety chains, $516,260,000; mail order companies, $524,276,000; department stores—small (sales under $600,000 each), $3,835,000; department stores—medium (sales over $600,000 and less than $4,000,000 each), $23,389,000; department stores—large (sales over $4,000,000 each), $186,011,000; specialty stores, $36,144,000; furniture, $60,284,000; lumber and building material firms, $15,384,000, jewelry stores, $2,706,000.

TABLE 10—RETAILERS' SALES AND INVENTORIES

(Annual figures, 1922 = 100)

Group and number of companies	1922	1923	1924	1925	1926	1927
Grocers—unit stores (12):						
Sales	100	96	104	110	107	113
Inventories	100	103	114	122	112	114
Grocery chains (6):						
Sales	100	130	144	221	256	283
Inventories	100	110	132	228	238	252
Unit shoe stores (13):						
Sales	100	107		108	113	110
Inventories	100	107	..	99	104	102
Shoe chains (2):						
Sales	100	108	134	187	224	262
Inventories	100	116	140	206	242	264
Cigar chains (2):						
Sales	100	106	118	129	141	
Inventories	100	124	117	134	151	..
Variety chains (5):						
Sales	100	118	134	153	175	196
Inventories	100	111	111	104	148	154
Mail order companies (3):						
Sales	100	127	136	149	154	159
Inventories	100	118	109	141	125	133
Department stores—small (12):						
Sales	100	107	102	106	108	106
Inventories	100	107	99	95	89	93
Department stores—medium (12):						
Sales	100	107	106	114	114	107
Inventories	100	106	106	109	103	101
Department stores—large (12):						
Sales	100	111	115	119	126	130
Inventories	100	113	114	114	113	114
Specialty stores (11):						
Sales	100	116	117	127	140	148
Inventories	100	101	104	113	121	127
Furniture stores (13):						
Sales	100	128	134	142	155	166
Inventories	100	117	126	125	143	131
Lumber and building material firms (10):						
Sales	100	116	116	132	140	145
Inventories	100	115	124	126	136	140
Jewelry stores (17):						
Sales	100	108	115	122	127	130
Inventories	100	104	108	110	112	113

the ratio of inventories to sales, but rather the relative increase or decrease in sales and in inventories from year to year. Thus for 12 unit grocery stores, sales in 1923 were 96 per cent of the sales in 1922, and inventories in 1923 were 103 per cent of the inventories in 1922—a decline of 4 per cent in sales and an increase of 3 per cent in inventories. In the case of specialty stores, to give another illustration, sales were 48 per cent greater in 1927 than in 1922 and inventories increased 27 per cent during the same period.

The number of unit grocery stores included was too small to provide a basis for a safe judgment. Acquaintance with the grocery trade, however, leads one to conclude that, as these figures suggest, there has been little change in the relation between inventory and volume of business handled in unit grocery stores. Grocery chain store companies rapidly expanded their operations after 1922. When the big increase came in 1925, however, merchandise inventories increased even more rapidly than sales. In 1926 and 1927, sales showed the more rapid increase.

In the small number of unit shoe stores covered in the table, merchandise inventories tended to increase less rapidly than sales; the effects of hand-to-mouth buying were clearly reflected there. In two large chains of shoe stores, on the other hand, merchandise inventories tended to increase fully as rapidly as sales increased. In the cigar chains, a heavy increase in inventories took place in 1923, but thereafter sales rose somewhat more rapidly than stocks of new merchandise on hand. The variety chains, mail order companies, department stores, metropolitan specialty stores, furniture stores, and jewelry stores showed a tendency for sales to increase more rapidly than inventories. In the retail lumber and building material trade, the sales and inventory indexes fluctuated roughly together.

In order to obtain a finer test of department store experience, the data, shown in Table 11, were secured from three well-managed metropolitan department stores. These data show relative changes in sales and monthly inventories by selected departments.

The figures in Table 11 show marked differences between departments within a single store and also differences between stores in handling inventories. In Store A, in all three departments the tendency definitely was toward lower inventory ratios, whereas in Store B, inventories roughly followed sales in two departments and were tending to be slightly higher, in ratio to sales, in two other departments. In Store C, the ratios of inventories to sales increased in both departments.

In general, it may be added, the ratio of sales to inventories in numerous retail stores has been affected by the tendency for certain types of trade to concentrate in larger stores in trading centers. Such stores usually are able to secure a higher rate of stock-turn than small stores. Standardization and simplification of inventories also have aided, in some instances, in securing better inventory ratios, but in many other instances the multiplication of styles has been working in the opposite direction.

In Table 12, sales and inventory indexes, computed from data obtained from private sources, are given for five groups of wholesalers.[30] The firms were selected at random and probably were typical.

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[30] The aggregate sales of these groups of wholesale firms in 1927 were as follows: light hardware, $20,462,000; heavy hardware, $38,710,000; drugs, $29,411,000; dry goods, $83,025,000; grocery, $37,220,000.

TABLE 11.—DEPARTMENT STORES—DEPARTMENTAL NET SALES AND MONTHLY AVERAGE INVENTORIES (AT COST)

(1922 = 100)

	1922	1923	1924	1925	1926	1927
STORE A						
Hosiery department:						
Sales	100	103	111	123	138	158
Inventories	100	83	75	83	114	80
Misses inexpensive dresses department:						
Sales	100	101	113	124	146	177
Inventories	100	126	95	90	84	116
Millinery department						
Sales	100	127	141	143	162	178
Inventories	100	136	138	123	111	123
STORE B						
Hosiery department						
Sales	100	84	78	82	87	92
Inventories	100	89	81	76	87	79
Ladies' coat department:						
Sales	100	100	110	107	100	109
Inventories	100	122	98	109	135	115
Domestic department.						
Sales	100	100	91	97	96	87
Inventories	100	94	81	73	96	89
Silk department:						
Sales	100	100	98	111	103	88
Inventories	100	111	103	108	121	100
STORE C						
Hosiery department						
Sales	100	80	83	70	68	70
Inventories	100	76	78	86	92	83
Knit underwear department:						
Sales	100	103	122	109	123	130
Inventories	100	117	132	151	169	143

TABLE 12—WHOLESALERS' SALES AND INVENTORIES

(Annual figures, 1922 = 100)

Group and number of companies	1922	1923	1924	1925	1926	1927
Light hardware wholesalers (11)						
Sales	100	114	113	118	119	122
Inventories	100	106	106	106	107	102
Heavy hardware wholesalers (17).						
Sales	100	116	111	115	114	112
Inventories	100	113	111	113	110	108
Drug wholesalers (11):						
Sales	100	111	110	111	114	116
Inventories	100	108	104	106	105	103
Dry goods wholesalers (18):						
Sales	100	113	105	106	104	100
Inventories	100	126	108	110	96	103
Wholesale grocers (9).						
Sales	100	106	104	107	103	101
Inventories	100	107	121	123	117	104

Among the wholesale groups shown in Table 12, the wholesalers of light hardware were most notably successful in handling an increasing volume of business with relatively stable inventories. The heavy hardware wholesalers and the drug wholesalers showed a slightly slower rate of increase in inventories than in sales. For the dry goods wholesalers and wholesale grocers, on the other hand, inventories tended to increase more rapidly than sales. The differences between the various trades revealed here suggest a fertile opportunity for further research.

In Table 13, sales and inventory figures are given for 241 manufacturing and mining companies,[31] whose sales in 1927 amounted to approximately $7,272,000,000. The data from which these computations were made were obtained in part from published, and in part from unpublished, confidential sources. The inventory figures were taken from balance sheets and the sales from operating statements. In making the computations for this table, as for the preceding tables, the relatives were computed for each company individually, and the group relatives are the simple, unweighted averages of the relatives for individual companies. The annual figures for 1922 were taken as the base on which to compare the relatives for sales and inventory changes in subsequent years, because 1922 marked the turning point in the depression that followed the crisis of 1920 and because that year was not open to greater objections than could be raised against any other year in the period as a base. It is to be remembered, furthermore, that the inventory figures include raw materials, goods in process, and finished goods, with the result that in some instances the effects of decreases in raw material inventories probably have been largely offset by increases in stocks of finished goods carried.

Hand-to-mouth buying, changes in plant operating methods, and improved transportation conditions—the factors which have tended to

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[31] The aggregate sales of these groups of manufacturing companies in 1927 were as follows: cotton cloth mills, $68,221,000; cotton cloth converters, $33,179,000; shirt manufacturers, $31,098,000; hosiery manufacturers, $20,270,000; knit goods manufacturers, $29,386,000; woolen and worsted mills, $36,767,000; men's clothing manufacturers, $36,361,000; textile manufacturers—miscellaneous, $79,949,000; tanners, $40,517,000; shoe manufacturers, $277,260,000; tire and rubber manufacturers, $781,582,000; automobile parts and accessories manufacturers, $52,907,000; passenger automobile manufacturers, $1,589,571,000; motor truck manufacturers (1926), $124,651,000; iron and steel manufacturers, $1,679,087,000; miscellaneous metal working companies, $52,944,000; miscellaneous machinery manufacturers, $107,089,000; electrical goods manufacturers, $542,836,000; building material manufacturers, $166,359,000; soap manufacturers, $217,686,000; paper and pulp mills (1926), $20,453,000; printers and lithographers, $17,781,000; furniture, piano, and radio manufacturers. $225,529,000; candy and soft drink manufacturers, $49,954,000; grocery manufacturers, $309,734,000; meat packers, $263,279,000; coal mining companies, $51,186,000; nonferrous metal mining companies, $255,818,000; oil producing companies, $110,376,000.

TABLE 13.—SALES AND INVENTORIES OF INDUSTRIAL COMPANIES

(Annual figures, 1922 = 100)

Group and number of companies	1922	1923	1924	1925	1926	1927
Cotton cloth mills (18).						
Sales.	100	128	126	140	132	133
Inventories	100	122	109	132	96	117
Cotton cloth converters (10):						
Sales	100	114	107	113	103	104
Inventories	100	116	115	105	88	108
Shirt manufacturers (2)						
Sales	100	110	92	97	96	90
Inventories	100	117	77	87	63	68
Hosiery manufacturers (8).						
Sales	100	113	99	122	118	111
Inventories	100	105	99	103	112	105
Knit goods manufacturers (10).						
Sales	100	125	117	131	128	125
Inventories	100	101	88	96	88	98
Woolen and worsted mills (10).						
Sales	100	141	149	148	131	123
Inventories	100	108	123	106	96	95
Men's clothing manufacturers (13):						
Sales.	100	125	121	130	120	123
Inventories	100	121	126	132	114	139
Textile manufacturers, miscellaneous (8):						
Sales	100	139	118	132	128	117
Inventories	100	118	150	144	148	144
Tanners (11).						
Sales	100	115	111	118	119	130
Inventories	100	111	112	120	114	126
Shoe manufacturers (15):						
Sales	100	120	119	129	131	128
Inventories	100	108	107	107	113	114
Tire and rubber manufacturers (6)						
Sales.	100	115	129	165	179	168
Inventories	100	125	117	160	176	176
Automobile parts and accessories manufacturers (6):						
Sales.	100	142	118	127	147	117
Inventories	100	104	87	112	127	91
Passenger automobile manufacturers (6):						
Sales	100	131	102	125	201	190
Inventories	100	121	109	124	133	153
Motor truck manufacturers (4):						
Sales	100	134	149	208	229	204
Inventories	100	134	157	201	234	207
Iron and steel manufacturers (6):						
Sales	100	162	138	155	161	151
Inventories	100	130	138	126	127	138
Miscellaneous metal working companies (13):						
Sales	100	141	131	139	145	130
Inventories	100	116	110	120	121	118
Miscellaneous machinery manufacturers (16).						
Sales	100	135	126	132	128	138
Inventories	100	124	115	108	113	118
Electrical goods manufacturers (7):						
Sales	100	130	137	141	161	157
Inventories	100	117	110	125	133	124

TABLE 13.—(*Continued*)

Group and number of companies	1922	1923	1924	1925	1926	1927
Building material manufacturers (9)						
Sales	100	140	143	155	163	176
Inventories	100	116	124	140	145	154
Soap manufacturers (2):						
Sales	100	110	124	148	172	192
Inventories	100	105	141	132	142	159
Paper and pulp mills (6)						
Sales	100	124	116	135	145	
Inventories	100	110	100	134	135	. .
Printers and lithographers (4).						
Sales	100	115	137	129	154	163
Inventories	100	104	101	116	130	124
Furniture, piano, and radio manufacturers (9)						
Sales	100	134	172	167	192	194
Inventories	100	123	131	140	167	150
Candy and soft drink manufacturers (5).						
Sales	100	114	115	124	129	123
Inventories	100	126	118	132	138	138
Grocery manufacturers (7):						
Sales	100	114	129	149	169	181
Inventories	100	114	127	168	177	231
Meat packers (5):						
Sales	100	119	133	164	183	180
Inventories	100	115	121	159	135	108
Coal mining companies (6):						
Sales	100	125	111	83	95	89
Inventories	100	123	108	96	91	102
Nonferrous metal mining companies (13):						
Sales	100	113	114	121	131	119
Inventories	100	131	102	98	111	136
Oil producing companies (6)						
Sales	100	123	136	167	221	222
Inventories	100	135	132	147	165	212

permit industrial companies to handle a given volume of business with smaller inventories than formerly were required—have affected different industries to varying degrees.[32] The small size of the samples for some of the industries listed in Table 13 renders it unsafe to attempt to draw precise comparisons between inventory changes in the various industries. These figures do show, nevertheless, that the net changes in inventories have not followed uniform tendencies in all industries. The situation has been mixed.

In the men's clothing industry, cotton cloth converting business, tanning industry, tire and rubber industry, motor truck industry, miscellaneous metal working plants, automobile parts and accessories industry, iron and steel industry, building material industry, oil industry, woolen and worsted industry, nonferrous metal mining industry, and coal mining industry, no well-established tendency to keep inventories at a lower ratio to sales was manifested. In those industries, the inventory and sales figures do not show any regular tendency toward a net reduction in inventory ratios. In the tanning industry, to be sure, there was a suggestion of a tendency toward lower inventory ratios after 1925, but it was slight. In the miscellaneous metal working plants, in the automobile parts and accessories industry, in the building material industry, in the iron and steel industry, and in the woolen and worsted industry a large increase in sales occurred in 1923 which was not accompanied by a corresponding increase in inventories; after 1923, however, further improvement in inventory ratios did not occur in those industries.

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[32] Wide diversities have appeared also in the inventory practice of different companies within a single industry, one company occasionally increasing its sales greatly with small change in its inventory investment, or, in another case, piling up a large inventory with no corresponding increase in sales. Figures for these exceptional cases were not included in the preparation of Table 13.

Among the producers of miscellaneous textiles, candy and soft drinks, and groceries, inventories increased out of proportion to sales; in those industries the tendency was for the producers from whom operating reports were available for this study to carry heavier inventories for handling a given volume of business. In some cases, the increases in inventory ratios were the result, partially at least, of the operation of sales branches or of the carrying of more numerous warehouse stocks.

In another large group of industries, including cotton cloth mills, shirt manufacturers, hosiery manufacturers, knit goods manufacturers, shoe manufacturers, passenger automobile manufacturers, miscellaneous machinery manufacturers, electrical goods manufacturers, paper and pulp mills, printers and lithographers, furniture, piano, and radio manufacturers, and meat packers, the tendency definitely was for inventories to increase less rapidly than sales increased or to fall more rapidly as sales declined. In the case of the manufacturers of passenger automobiles, an especially noteworthy change occurred after 1925, when sales increased far more rapidly than inventories.

The aggregate volume of sales of all the industrial companies whose sales and inventory figures were used in preparing Table 13 amounted to approximately $7,272,000,000 in 1927; the aggregate inventories in the same year were approximately $1,589,000,000. The relatives for the aggregate sales of those companies were as follows: 1922, 100; 1923, 132; 1924, 122; 1925, 140; 1926, 156; 1927, 153. The relatives for the aggregate inventories were: 1922, 100; 1923, 119; 1924, 111; 1925, 120; 1926, 124; 1927, 124. The figures for the changes in aggregate sales and inventories from 1922 to 1927 represented a large volume of business and probably were fairly representative of industrial enterprises in total. If that premise is accepted, it leads to the conclusion that at the end of 1927 inventories of raw materials, goods in process, and finished goods in the hands of industrial companies were about 20 per cent less than they would have been if hand-to-mouth buying, changes in production methods, and improvements in transportation conditions had not occurred between 1922 and 1927. For the 241 industrial corporations for which data were presented above, the inventory requirements, on that basis of computation, were $375,900,000 less in 1927 than they would have been at the 1922 ratios.

Some of the reasons why the reductions in inventory ratios were not greater in some industrial concerns were briefly as follows. In several industries, such as oil, cement, motor trucks, and certain branches of the chemical industry, there was overproduction during all or a part of the period from 1922 to 1927. When overproduction takes place, inventories tend to accumulate. In the second place, numerous manufacturers were impelled to carry larger stocks of finished goods, either in factory warehouses or in warehouses at distributing points, in order to meet the insistent demands of customers for immediate deliveries. Hand-to-mouth buying by wholesalers and retailers threw back upon many manufacturers more of an inventory burden, with its attendant risks of price decline and style depreciation.

The effects of hand-to-mouth buying also operated to keep the material and supply inventories of railroads at substantially lower figures than they otherwise would have been. For all Class I steam railways in the United States, the inventories of materials and supplies were reduced from $545,026,522 in 1922 to $523,520,208 in 1927, whereas total railway operating revenues increased approximately 10 per cent during the same period. The railroad companies aided manufacturers and merchants to effect inventory retrenchments, through quick and dependable transportation service, and they also have made an actual reduction in their own inventory investments.

It is evident, from the foregoing evidence, that the aggregate merchandise inventories carried by merchants, manufacturers, other industrial companies, and railroads were materially less in 1927 than they would have been if hand-to-mouth buying, changes in plant operating methods, and improvements in transportation had not taken place. While the changes in inventory ratios were not uniform for all industries and no actual release of capital occurred, nevertheless the effect of these influences was to lessen the demands that otherwise would have been made for capital or credit to finance inventory investments. To have handled the same volume of production, traffic, and trade in 1927, without hand-to-mouth buying, would have required over a billion dollars of capital and credit beyond the amount that actually was employed for inventory purposes under existing conditions.

The net effects of hand-to-mouth buying during the period from 1922 to 1927 cannot be measured precisely. On the one hand, the selling, buying, and handling expenses of numerous companies were increased thereby. On the other hand, the capital and credit requirements for financing inventories were lightened in the aggregate; the evils of returning merchandise for credit probably were lessened in wholesale trade; and the losses from depreciation of merchandise subject to rapid style changes were minimized. Hand-to-mouth buying, in fact, was in considerable measure a means of defense against rising costs during a period when changes in demand were resulting in a large increase in the varieties of merchandise offered for sale and in rapidly changing styles, and when prices of staple merchandise either were stationary or tending to decline. The lightening of the demand for capital and credit, however, probably was the chief result of hand-to-mouth buying, and that lightening of the demand for capital and credit must have been a large factor in facilitating industrial expansion and the rise in security prices.

IV. CHANGES IN DISTRIBUTION

Changes in trade channels have occurred during the last ten years both in industrial marketing and in the marketing of consumers' goods. In the industrial field, the changes have been of significance primarily from the standpoint of business administration rather than for the interpretation of general economic conditions. An exception to this statement applies to agricultural raw materials, the co-operative marketing of which is taken up in a later section.

An example of the changes in the distribution of industrial goods is afforded by the chemical industry, where various manufacturers since 1918 have dispensed with the services of brokers and dealers and have adopted the practice of selling their products directly to users. Some manufacturers in other industrial trades have replaced their distributors by opening sales branches, while others have replaced branches by distributors. In many lines of industrial goods the methods of distribution have been highly unsettled, without an indication, as yet, of what the trend is to be. Numerous examples illustrating these mixed conditions could be cited, but, as previously stated, they would pertain chiefly to technical problems of business administration.

In marketing consumers' goods, some of the changes in distribution have been primarily of significance to business executives without broad economic implications. An example of this sort might be found in a study of the position of the broker in the grocery trade or in the increased use of public warehouses by manufacturers who deem it necessary to carry stocks at strategic points for distribution to retailers or wholesalers. The major changes in the distribution of consumers' goods, however, have been of general economic significance. These include such changes as the growth of chain stores, and new developments in the department store and mail order businesses and in wholesale trade.

Chain Stores.—The growth of the sales of chain store companies in certain trades is indicated by Table 14, prepared by the Division of Research and Statistics of the Federal Reserve Board. The same companies were not included for every year, but the method of computation which was used by the Federal Reserve Board made allowances for the difference in the number of companies for which data were available. These figures reflect the aggregate volume of business for those companies that reported. They do not indicate, of course, the changes in the volume of sales per store, and since not all chains reported and not all trades were included, they do not indicate the entire development of the chain store business. They do afford, nevertheless, a valuable index.

TABLE 14.—CHAIN STORE SALES—ANNUAL INDEXES[a]

(Monthly average 1923-1925 = 100)

Year	Grocery	5 and 10 cent	Wearing apparel	Drug	Cigar	Shoe	Candy
1919	45	53	36	64	72	76	53
1920	66	64	52	78	96	91	73
1921	59	66	59	79	95	86	75
1922	69	74	64	82	93	86	77
1923	85	88	83	93	98	93	93
1924	97	99	98	98	100	101	101
1925	118	113	119	109	102	106	106
1926	143	125	149	126	111	113	114
1927	174	138	189	143	110	115	119

[a] *Federal Reserve Bulletin*, April, 1928, p 234

These indexes show that a rapid increase in chain store sales occurred after 1922, particularly in the grocery, 5 and 10 cent, wearing apparel, and drug trades. These conclusions are supported by data obtained from other sources.

The only dependable information regarding the proportion of retail trade handled by chain stores is that obtained by the Census of Distribution taken by the United States Bureau of the Census in 11 cities for the year 1926. A detailed analysis of the census figures for sales by unit stores and chain stores was published[33] by the Domestic Distribution Department of the Chamber of Commerce of the United States, which had sponsored the census. The chain store sales amounted to 30.66 per cent of the total retail trade in Atlanta, 22.44 per cent in Baltimore, 37.13 per cent in Chicago, 19.52 per cent in Denver, 6.34 per cent in Fargo, N. D., 17.88 per cent in Kansas City, 20.55 per cent in Providence and environs, 22.57 per cent in San Francisco and environs, 19.55 per cent in Seattle, 18 per cent in Springfield, Ill., and 14.84 per cent in Syracuse, N. Y.

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[33] Chamber of Commerce of the United States, Domestic Distribution Department, *Retail and Wholesale Trade*, Washington, May, 1928.

The number of unit stores, the number of chain stores, and the proportion of the retail business handled by each group, in the 11 cities combined, were as shown in Table 15 for selected trades.

TABLE 15—CHAIN STORE SALES AND UNIT STORE SALES IN 11 CITIES, 1926

Kind of stores	Number		Total sales		Percentage of total sales	
	Unit stores	Chain stores	Unit stores	Chain stores	Unit stores	Chain stores
Grocery and delicatessen	16,500	4,386	$286,767,800	$201,741,200	58.7	41.3
Drug	3,876	521	109,348,300	46,543,900	70.1	29.9
Variety	164	201	16,686,100	40,293,300	29.3	70.7
Women's clothing	1,426	246	121,548,300	22,480,000	84.4	15.6
Men's ready-made clothing	2,485	349	123,541,700	28,946,700	81.0	19.0
Men's hats and caps	169	86	3,625,800	3,880,400	48.3	51.7
Shoe	1,475	555	44,116,300	47,430,200	48.2	51.8
Cigar	2,900	380	32,378,100	17,840,700	64.5	35.5
Confectionery, ice cream, and soft drinks	6,289	388	46,842,600	17,971,700	72.3	27.7
Automobiles	762	256	203,004,100	92,526,400	68.7	31.3
Auto accessories	1,907	170	49,891,900	11,920,500	80.7	19.3
Bakery shops	2,418	248	56,674,300	7,289,600	88.6	11.4
Building materials	809	167	129,077,800	22,907,200	84.9	15.1
Coal, wood, and ice	1,153	150	64,532,100	25,327,000	71.8	28.2
Dairy and poultry products	514	63	39,745,000	31,226,100	56.0	44.0
Dry goods and notions	3,105	187	82,437,400	7,398,300	91.8	8.2
Electrical appliances and supplies	679	71	26,852,600	11,122,500	70.7	29.3
Fruit and vegetables	2,280	426	32,743,700	3,443,800	90.5	9.5
Fur and fur clothing	326	28	19,179,000	2,415,000	88.8	11.2
Furniture and house furnishings	2,458	386	137,957,000	67,400,100	67.2	32.8
Gasoline and oil	2,215	1,920	36,456,900	100,985,400	26.5	73.5
Hardware	2,111	361	74,289,900	7,508,300	90.8	9.2
Jewelry	1,291	79	47,065,000	9,798,200	82.8	17.2
Meat, poultry, and fish	5,222	490	145,708,900	24,203,200	85.8	14.2
Millinery	881	326	13,973,800	8,163,000	63.1	36.9
Musical instruments	479	76	26,530,400	9,935,400	72.8	27.2
Paint, varnish, and glass	547	30	14,594,700	2,710,500	84.3	15.7
Plumbing and heating fixtures and supplies	648	71	30,558,200	3,056,700	90.9	9.1
Stationery	893	168	31,940,100	5,644,600	85.0	15.0

The data in Table 15, although for only one year and for only 11 cities, furnish an invaluable basis for judging the significance of the Federal Reserve Board's indexes and for obtaining a view of the part that chain stores play in trades not included in those indexes.

The expansion of the chain store business since 1922 has come about in part through the organization of new companies and in part through the opening of new stores by companies then in operation. The grocery trade is one in which the foregoing statistics show that chain store growth has been especially rapid. In that trade, the increase in the sales per store has been relatively small, but the number of stores has expanded rapidly. In Table 16, the average sales per store are computed for several large chains of grocery stores which publish statements of their annual sales and give the number of stores.

TABLE 16.—AVERAGE ANNUAL SALES PER STORE,[a] GROCERY CHAINS

Year	H. C. Bohack & Co. (Inc.)	Safeway Stores (Inc.)	Sanitary Grocery Co. (Inc.)	National Tea Co.	Kroger Grocery & Baking Co.
1922		$65,279	.	$69,940	$34,129
1923	$68,077	64,554	$51,967	60,880	39,754
1924	65,642	64,994	49,034	65,316	41,022
1925	57,726	66,710	51,484	62,353	40,699
1926	55,100	67,579	51,768	63,878	43,339
1927	54,254	63,176	48,795	..	

[a] The figures in this table for H. C. Bohack & Co. (Inc.) and for Kroger Grocery & Baking Co. were computed by dividing the sales of each company by the number of grocery stores operated. Inasmuch as both companies also operate meat markets, which in some instances are separate from the grocery stores, some error is involved, but it would not affect the general conclusions drawn. In the case of the National Tea Co., the sales made by route wagons were included and the figures of the average sales per store, therefore, are somewhat too high.

For the sales of individual companies mentioned here and in subsequent paragraphs, data have been obtained chiefly from *Moody's Analyses of Investments*, Industrial Section, 1927, Hoit, Rose & Troster, *Manual of Chain Stores*, New York, December, 1927. Other recent publications giving data on chain stores are Paul T. Cherington, "Chain Stores in the Grocery Business," *J. Walter Thompson News Bulletin*, September, 1927, p. 1; Frank Seaman (Inc.), *The Chain Store*, New York, March, 1928, George H. Burr & Co., *Why Chain Store Securities are Exceptional Investments*, New York, 1928, and *The Chain Store Age*.

The increase in the total sales of these companies was as follows: H. C. Bohack & Co. (Inc.), from $15,317,284 in 1923 to $21,159,069 in 1927; Safeway Stores (Inc.), from $12,468,290 in 1922 to $76,484,749 in 1927; Sanitary Grocery Co. (Inc.), from $11,121,037 in 1923 to $17,615,137 in 1927; National Tea Co., from $20,632,332 in 1922 to $58,801,377 in 1927; and Kroger Grocery & Baking Co., from $53,753,563 in 1922 to $161,261,353 in 1927.

Other large grocery chains for which sales figures have been published experienced the following growth: The Great Atlantic & Pacific Tea Co., from $202,433,531 in 1922 to $352,093,342 in 1925;[34] American Stores (Inc.), from $85,866,395 in 1922 to $120,664,568 in 1927; The First National Stores (Inc.), from $40,673,592 in 1922 to $64,445,962 in 1927; David Pender Grocery Co., from $4,263,106 in 1922 to $12,599,161 in 1927. There are, of course, numerous other large chain store companies in the grocery trade; sufficient evidence has been given, however, to depict the growth of this type of institution in the grocery business during recent years, and the quotation of data regarding additional companies would add little to the general picture. Here is one field, obviously, in which expansion has been remarkably rapid since 1921, but that expansion has been achieved in large part at the expense of other types of distributors.

[34] Sales for later years not published.

In the drug trade, chain store companies are not so large individually as in the grocery trade and they do not handle, apparently, quite so large a proportion of the total business in their trade as is handled by the chain stores in the grocery trade. The increase in the number of companies and in the number of stores from 1921 to 1928 is shown in Table 17:[35]

TABLE 17.—CHAIN DRUG STORE COMPANIES

Year	Total number of chain store companies	Total number of stores	Number of companies operating 10 or more stores	Number of stores operated by companies having 10 or more stores
1921	303	1,763	24	650
1923	327	2,014	34	837
1925	320	2,173	34	972
1928.	328	2,725	40	1,513

From these data it is apparent that the chief expansion of chain stores in the drug trade during this period was by companies operating over 10 stores each. The largest chain store company in this field is the Louis K. Liggett Co., a subsidiary of the United Drug Co. The sales of that chain increased from $32,721,798 in 1922 to $58,456,694 in 1927. The Walgreen Co., which was started in Chicago in 1920 with 19 stores, had 138 stores in 1927 and its sales in the latter year were about $20,000,000.[36] The Owl Drug Co. increased its sales from $11,025,088 in 1922 to $17,069,031 in 1926.

The companies operating chains of candy stores did not expand so rapidly during this period as the chain store companies in several other fields; that fact is indicated by the indexes published by the Federal Reserve Board. In itself, nevertheless, the expansion of the candy chains was noteworthy. Some of the large chain store companies in this field are as follows: Frank G. Shattuck Co., operating "Schrafft's" stores, with 29 stores and sales amounting to $13,247,470 in 1926; Loft (Inc.), with 45 stores and sales of $7,873,223 in 1927; Happiness Candy Stores (Inc.), with 76 stores and sales of $7,509,026 in 1927; Page & Shaw (Inc.), with stores in 12 cities and sales of $5,350,000 in 1926; the Mary Lee Candy Shops (Inc.), with over 50 stores and sales of $1,364,980 in 1926; Fanny Farmer Candy Shops (Inc.), with 110 stores and sales of $3,722,528 in 1927. The last two companies showed a particularly rapid rate of growth during the period from 1922 to 1926–27.

Three special features of the chain store development in the candy trade deserve mention. The first is the fact that nearly all these chain store companies operated factories for the manufacture of the goods sold in their stores, whereas the grocery, drug, and variety chains, with few exceptions, were primarily mercantile organizations. Several of the candy chains, in the second place, operated restaurants or lunch counters in their stores. A third fact to be noted is the alliance of the Happiness Candy Stores (Inc.) with the United Cigar Stores Co. of America, and the control of Huyler's, a chain of 51 candy stores, by D. A. Schulte (Inc.) and the Schulte Retail Stores Corporation.

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[35] *The Druggists' Circular*, March, 1928, p. 6.

[36] *Ibid.*, March, 1928, p. 6.

The largest chain of tobacco stores was operated by the United Cigar Stores Co. of America. Its sales increased from $72,484,254 in 1922 and $73,199,273 in 1923 to $87,262,218 in 1926 and the number of stores from 2,439 in 1923 to 3,134 in 1926. The second large chain of tobacco stores was operated by the Schulte Retail Stores Corporation, with 239 stores in 1922 and 296 in 1927 and with sales of $23,765,364 in 1922 and $41,342,011 in 1927.

In March, 1928, it was announced that the Schulte Retail Stores Corporation and the United Cigar Stores Co. of America had formed a new company, to be known as Schulte-United 5 cent to $1 Stores (Inc.), to operate a chain of variety stores. Thus the two large chains of tobacco stores not only had a controlling interest in two chains of candy stores, but they united to organize and operate a chain of variety stores, a suggestive ramification of enterprises.

The variety store field is one of those especially dominated by chain stores; in 1926, the census figures for the 11 cities showed that 70.7 per cent of the total sales of variety stores were made by chain stores. The only large company in this field which now restricts its selection of merchandise to articles that can be sold for 5 or 10 cents is F. W. Woolworth Co., one of the pioneer chain store undertakings. The company had 1,182 stores in 1922 and 1,581 in 1927. Its total sales in 1922 were $167,319,365 and $272,754,046 in 1927. Its sales per store amounted to $141,556 in 1922 and to $172,520 in 1927.

One of the effects of the rapid rise in prices from 1915 to 1920 and the continuance of a scale of prices after 1920 generally higher than that of 1913 was to induce numerous companies operating chains of variety stores to cease confining their merchandise selection to 5 and 10 cent items and instead to cover a range from 5 cents to $1. This change in price limit gave them a wider opportunity for selection of merchandise than was possible under the 10 cent limitations. S. S. Kresge Co. has two classes of stores, one selling merchandise from 5 to 25 cents in price; and the other, merchandise from 25 cents to $1. In 1922 that company had 212 stores of both classes, with sales of $65,191,467, and in 1927 its total sales, in 435 stores, amounted to $133,847,477. Its sales per store averaged $307,507 in 1922 and $307,695 in 1927.

S. H. Kress & Co., selling 5, 10, and 25 cent merchandise, with higher-priced goods in a few stores, had 145 stores in 1922, with sales of $30,646,-

937; in 1927 it had 183 stores and sales of $58,059,925. The sales per store in this case showed an increase from $211,358 in 1922 to $322,731 in 1927. The McCrory Stores Corporation, also handling variety goods, increased the number of stores from 161 in 1922 to 221 in 1927 and its sales from $17,123,252 to $39,336,090. The W. T. Grant Co., selling merchandise priced 5 cents to $1, mostly over 25 cents, increased the number of stores from 45 in 1922 to 109 in 1927. Its total sales increased from $12,728,412 in 1922 to $36,074,617 in 1927 and its sales per store during the same period from $282,854 to $330,960. The increase in the volume of sales per store in these variety chains was in contrast to the development in the grocery trade. The variety chains in most instances expanded their operations, not only by increasing the number of stores, but also by increasing materially the volume of sales per store. In addition to the chain store companies in the variety field listed here, there are various others, some of which have sales over $10,000,000 each.

Stores like those operated by W. T. Grant Co. handle large quantities of dry goods and have many of the characteristics of department stores, except with respect to the limits on the price range. In the dry goods field proper, the J. C. Penney Co. operates the largest chain. The retail stores owned by this company are located chiefly in small cities and large towns. In 1922 the company was operating 371 stores, with sales of $49,035,729; in 1927 it had 930 stores, with sales of $151,957,865. The average sales per store were $132,172 in 1922 and $163,395 in 1927.

In the department store field there are several companies operating stores in 12 to 30 or 40 medium-size cities. There also are a few large companies, such as the May Department Stores Co., the Associated Dry Goods Corporation, and the National Department Stores (Inc.), which are operating under central ownership but without the same centralization of merchandise control that exists in chain stores in most other trades. In December, 1928, announcement was made of the organization of Hahn Department Stores (Inc.), through the merger of 22 companies operating 27 department stores located in 25 cities, the total sales of those stores amounted to $108,000,000 in 1927. It was further stated that this group of stores was the nucleus around which a larger organization was to be built. Some concentration of ownership is taking place, therefore, in the department store field, but, in the main, department stores deserve separate consideration.

In addition to the chain store developments just discussed, attention should be called to similar developments in other trades. In 1926, in the 11 cities covered by the Census of Distribution, 73.5 per cent of the sales in gasoline and oil stores, 51.8 per cent of the sales of shoe stores, 44 per cent of the sales of dairy stores, 36.9 per cent of the sales of millinery stores, and 32.8 per cent of the sales of furniture and house furnishings stores were made by chain stores. In some instances chains were operated by mercantile companies and in other instances by manufacturers. In the gasoline business and in the shoe trade, manufacturers' chains of retail stores have been especially conspicuous.

The Federal Reserve Board's indexes and the data for the individual companies show that in several trades chain store companies increased their sales at an extraordinary rate after 1922. There were variations between trades, and some lines of business were little affected by chain store developments. Some chain store experiments, furthermore, as, for example, that of the Winchester Co., did not succeed. Nevertheless, the chain store movement was widespread and during the period after 1922 there were few, if any, developments in the marketing field of equal significance. The chain stores expanded far more rapidly than general business; hence there was a displacement of other types of distributors. The expansion of the chain store business brought adversity to competing merchants.

Chain stores were in existence and prominent prior to 1922, and no new management or operating methods of outstanding significance have been introduced in the chain store field since 1921. Hence the expansion of the chain store business cannot be attributed to new discoveries or to radical improvements in methods of management and operation. Nevertheless, the economies in operation, resulting from the elimination of credit and delivery expenses and from the standardization of methods in chain stores, which had been significant prior to 1920, especially in the grocery, drug, and variety fields, were particularly potent after the crisis of 1920. The period since 1922 generally has been one of price competition, with a premium on economies in operation, and the chain stores in many instances have had aggressive management which thrived on price competition. As their volume of sales increased, the chain store companies were able to exert greater pressure on manufacturers in highly competitive markets and thus in some instances to secure special concessions in discounts, advertising allowances, or other forms of secret rebates.

In the shoe and clothing trades it does not appear that the chain store companies generally have had a substantial advantage over unit stores in operating expenses. The growth of chains in those trades, therefore, was occasioned by causes different from those which led to the growth of the grocery, drug, and variety chains. In several instances manufacturers were impelled to operate chains of shoe or clothing stores to counteract the influence of hand-to-mouth buying on the regularity of their plant operations, or to prevent obstruction to the flow of merchandise from their factories to consumers. In both the shoe and clothing trades, furthermore, some chains were formed to exploit the sale of low-priced merchandise. In the gasoline and oil business, the refining companies found it difficult to prevent substitution and to protect the reputation of their brands when their products were sold chiefly by independent stations. The desire to eliminate such abuses was an especially influential motive leading the refining companies to operate chains of filling stations.

An external influence affecting the growth of chain stores in various trades was the influx of new capital, as a result of the activities of investment bankers in promoting chain stores in order to obtain securities for sale during the stock market boom. This activity of the investment bankers in the chain store field was particularly noticeable in 1926 and 1927, the years during which the growth of the chain stores was most rapid.

The expansion of the chain store type of organization has represented an application of the capitalistic form of organization to several branches of retail trade which previously had been operated in small units. Some of the chief problems arising from this development remain to be faced. Attention has been called to the large scale of some of the chain store enterprises and to certain alliances that have been formed between chains in different fields. The growth of large retail organizations has resulted in the development of buying power which leads to a demand for concessions of various sorts from manufacturers. The situation is somewhat analogous to the conditions which once existed in the railroad business when large shippers sought and received preferential treatment.

No data are available on the changes in the number of unit stores during the last ten years, but there must have been a decline in the number of unit stores in those trades where the chain store growth has been most rapid. In the five years prior to 1919 there was some reduction in operating expenses in retail grocery stores, because of the chain store competition. The amount of credit extended by retail grocers had been curtailed substantially, and there probably has been some further development in the same direction since 1919. In other trades there has been diversification in the kinds of merchandise handled by retailers, but this has occurred in chain stores as well as in unit stores, and it is not possible to designate any definite change in operating methods as having occurred in the last ten years in unit stores as a means of meeting chain store competition. The fact that so few unit stores have materially improved their methods of management and operation points to one of the major reasons for the continued chain store growth.

Department Stores.—Department stores have felt the competition of chain stores selling variety goods and other types of merchandise at the lower end of the price scale. To a large extent, however, the department stores and typical chain stores have been noncompetitive. They both represent large capitalistic organizations catering to different buying habits of consumers. The chain store represents a standardization of merchandise and of operating methods, with a large number of small selling units located at strategic points operating under centralized control. The strength of the chain stores is in selling convenience goods and standard merchandise of low price. A department store, in contrast, comprises a large number of widely diverse departments brought together under one roof. In department stores, style goods and novelties are predominant. Those lines of merchandise which are best suited to chain store distribution are not well adapted to department store merchandising. The department stores have benefited by the widening of the retail trading areas which has led consumers from wider and wider territories to do their shopping in those communities where department stores are located. The following statement shows indexes for department store sales.

TABLE 18.—DEPARTMENT STORE SALES[a]

(1923–1925 average = 100)

1919	78	1924	99
1920	94	1925	103
1921	87	1926	106
1922	88	1927	106
1923	98		

[a] *Federal Reserve Bulletin*, February, 1928, p. 117

It is to be noted that the increase in the volume of sales of department stores was far less rapid than the increase in the sales of chain stores. There are instances of individual companies, as, for example, R. H. Macy & Co. (Inc.), New York City, which have increased their volume of sales rapidly, but in general the rate of increase has been much slower during the last ten years than in chain stores. This slower rate of growth of department stores may be accounted for by the fact that the department store market had been much more fully developed prior to 1920 than had the chain store market. Furthermore, the increasing traffic

TABLE 19.—OPERATING EXPENSES IN DEPARTMENT STORES

Year	Stores with annual sales less than $1,000,000[a]		Stores with annual sales over $1,000,000[b]	
	Number of stores	Total expenses (per cent net sales)	Number of stores	Total expenses (per cent net sales)
1922	340	27.1	151	28.6
1923	403	26.3	163	28.4
1924	399	28.2	168	30.1
1925	398	28.1	183	29.9
1926	284	28.7	163	30.3
1927	328	29.5	180	31.4

[a] Harvard University, Bureau of Business Research, *Bulletin* No. 74, "Operating Expenses of Department Stores and Departmentized Specialty Stores in 1927," p. 20.

[b] *Ibid.*, p. 3.

congestion in metropolitan districts probably tended to check the growth of the department store sales. There also was a prevalence of strong competition from specialty stores selling style goods. It is to be noted, too, that the operating expenses of department stores tended to increase during the period covered by this survey. The figures in Table 19 are taken from bulletins of the Harvard Bureau of Business Research. The same companies, for the most part, were included in these groups from year to year.

Mail Order Business.—The following statement of annual indexes shows the expansion of business of the large mail order companies from 1919 to 1927. These indexes were based upon the reports of four companies which had an aggregate volume of sales in 1927 of $562,765,581.

TABLE 20—SALES OF MAIL ORDER COMPANIES[a]

(Monthly averages 1923–1925 = 100)

1919	93
1920	96
1921	67
1922	73
1923	92
1924	98
1925	110
1926	115
1927	120

[a] *Federal Reserve Bulletin*, April, 1928, p 234.

It is to be noted that the mail order companies experienced a particularly severe decline in their volume of sales in 1921, from which full recovery was not made until 1924. This sharp drop in the sales of the mail order companies during a period of depression reflected a difficulty which is experienced by that type of enterprise when prices are declining rapidly. A mail order company issues a catalogue which normally remains in use for a period of six months. The prices in the catalogue thus look less and less favorable if prices in retail stores are falling. Even though the mail order company states that it will meet declines in the market, it is difficult for the company to notify all its potential customers of the prices at which it will sell at any one time, when those prices differ from the ones stated in the catalogue.

After 1924, the mail order companies showed a more rapid expansion of sales than was shown by the department stores. This increase did not reflect solely an increase in the regular mail order business. In 1926, Montgomery Ward & Co. (Inc.), began opening retail stores, located in towns of 3,000 to 6,000 population. In December, 1928, it was said to have about 230 such stores and 18 department stores in its chain; it was further announced that the company planned a chain of 1,500 stores. Sears, Roebuck & Co. began selling over the counter at its warehouse in Chicago in 1925, and in December, 1928, was reported to be operating a chain of 37 department stores and 155 smaller stores. The Sears, Roebuck & Co.'s department stores were located in the outskirts of large cities where ample parking accommodations were expected to be available. The Federal Reserve Board's figures include the sales of these companies in their retail stores as well as sales from their catalogues; hence, they are not a real index to the changes in the volume of catalogue selling during this period.

The decision of these two large mail order companies to operate chain stores is one of the most significant marketing developments during the period under review. Although no definite statement has been made by these companies, it is reasonable to infer that their decisions to open retail stores reflect the change in buying habits in the small towns and rural districts. The same factors which brought about the increase in the radius of trading areas, discussed in a previous section, inevitably tended to affect the mail order business. With the increased use of automobiles and good roads, consumers were likely to purchase less from catalogues, just as they purchased less from country retail stores. By going to trading centers, it was possible for the consumers to examine the merchandise and to buy the goods on the spot. These two large mail order companies, therefore, manifested keen foresight in utilizing their reputations to launch chains of stores. The volume of sales which the companies had attained in these stores by 1928, important though it was, did not have so great significance as the fact of their establishment, since that fact emphasized the trend in the change in trading areas and in the development of the chain store type of enterprise.

Although such companies as the Fuller Brush Co. and the Real Silk Hosiery Mills (Inc.) have attracted widespread attention to the sale of merchandise by house-to-house solicitation, only a very small percentage of the retail trade of the United States has been affected thereby, and their experience is interesting without being broadly significant.

Wholesale Trades.—The best index to the volume of sales of wholesale merchants is compiled by the Division of Research and Statistics of the Federal Reserve Board.[37] For its purposes, the Federal Reserve Board includes in the index the sales of manufacturers who sell directly to retailers, and in several trades, such as meat packing, shoe manufacturing, and furniture manufacturing, the manufacturers' figures predominate. In such trades as groceries, dry goods, hardware, and drugs, however, the Federal Reserve Board figures are chiefly for wholesale merchants. This index, therefore, furnishes a guide as to how wholesale merchants were faring in those trades.

The grocery and dry goods wholesalers tended to lose ground; the hardware wholesalers barely held their own; and the drug wholesalers showed a moderate increase in their volume of sales. These figures do not give a complete picture of the conditions in wholesale trade, because they do not reflect the number of wholesale firms which went out of

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[37] This index was explained in the *Federal Reserve Bulletin*, December, 1927, pp. 817–828.

TABLE 21.—SALES OF WHOLESALERS[a]

(1923–1925 average = 100)

Year	Groceries	Dry goods	Hardware	Drugs
1919	118	110	96	91
1920	126	107	116	95
1921	93	91	80	86
1922	93	89	86	87
1923	100	103	102	97
1924	101	97	97	99
1925	99	100	101	104
1926	98	94	100	107
1927	94	89	95	108

[a] *Federal Reserve Bulletin*, December, 1927, p 826

business during these years through voluntary or involuntary liquidation or through mergers, or which changed from the wholesale business to the chain store business. Liquidations, mergers, and shifts to chain store operation occurred in the grocery, drug, and dry goods trades. Some new firms came into the field, as, for example, the desk jobbers and cash-and-carry wholesalers in the grocery trade, but the sales of the newcomers did not equal the sales of the firms which went out of business.

When the indexes for the grocery and drug wholesalers are compared with the chain store indexes, and the dry goods wholesalers' figures with those for wearing apparel chains and for department stores, it is evident that since 1920 the wholesalers have been handling a smaller and smaller proportion of the trade in their respective lines.

The causes for the stationary or declining volume of sales of the wholesalers in several lines of business were varied.[38] The predominant influence, of course, was the growth of chain stores, operating on a scale sufficiently large to permit them to buy directly from manufacturers, sometimes on even more favorable terms than were granted to wholesalers. Another factor in the grocery and drug trades was the continued activity of retailers' co-operative buying associations, organized in the hope of enabling the unit stores to meet the price competition of chain stores. In the department store field some increase occurred after 1922 in group or syndicate buying, but that development did not have nearly so great an influence as certain other factors on the trade of dry goods wholesalers. The shift in trading areas tended especially to weaken the dry goods wholesalers, for, as has been pointed out, many dry goods wholesalers continued to send their salesmen to the small towns and country stores where the volume of business was falling off and where the traveling expenses were becoming higher and higher in proportion to sales. Hand-to-mouth buying by retailers, furthermore, led the wholesalers to send their salesmen over their territories more frequently.

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[38] Melvin T. Copeland, "The Present Status of Wholesale Trade," *Harvard Business Review*, April, 1928, p. 257.

In general, wholesalers were not alert in meeting the new merchandising conditions, occasioned by changes in demand and changes in consumers' buying habits. At the same time competition became keener and keener, with a tendency for expenses to increase to a higher proportion of sales. Various expedients were tried, such as private brands, the opening of cash-and-carry departments, and the organization of groups of stores into syndicates by individual wholesalers, but those expedients have not as yet proved an effective foil to chain store competition or an adequate substitute for up-to-date merchandising.

V. CO-OPERATIVE MARKETING[39]

In Table 22 is shown the number of farmers' co-operative associations reporting to the United States Department of Agriculture from 1913 to 1925.[40]

Table 22.—Co-operative Associations Reporting Active to the United States Department of Agriculture, 1913–1925[a]

Year	Cotton	Dairy	Forage crops	Fruits and vegetables	Grain	Live-stock	Nuts	Poultry and eggs	Tobacco	Wool
1913	35	1,085	2	293	1,079	99	15	2	3	7
1914	45	1,178	2	334	1,245	138	18	3	3	8
1915	50	1,264	3	389	1,450	202	21	5	3	10
1916	53	1,371	3	448	1,728	273	22	7	3	11
1917	56	1,492	4	477	1,939	358	24	10	3	12
1918	60	1,593	4	526	2,194	489	26	11	3	22
1919	66	1,719	5	604	2,594	699	29	11	7	42
1920	75	1,829	5	725	2,958	987	33	15	8	58
1921	83	1,970	9	852	3,093	1,275	34	26	10	64
1922	90	2,055	13	958	3,163	1,429	35	31	16	68
1923	99	2,112	14	1,059	3,195	1,488	38	43	19	72
1924	102	2,131	14	1,117	3,210	1,524	40	57	19	78
1925	106	2,136	14	1,121	3,212	1,529	40	59	19	80

[a] R. H Elsworth, "Agricultural Co-operative Associations," United States Department of Agriculture, *Technical Bulletin* No 40, Washington, 1928, p. 76.

Table 23 shows the net annual increase in the number of these associations in those trades in which the largest number were found for 1922–1925.

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[39] A particularly comprehensive reference on this subject is by R. B. Forrester, *Report upon Large Scale Co-operative Marketing in the United States of America*, Ministry of Agriculture and Fisheries, London, 1925.

[40] See, on co-operative buying and selling, Chap. VIII, Agriculture, pp. 579–581.

TABLE 23.—CO-OPERATIVE MARKETING ASSOCIATIONS: NET ANNUAL INCREASE IN NUMBER REPORTING ACTIVE TO THE UNITED STATES DEPARTMENT OF AGRICULTURE

Year	Cotton	Dairy	Fruit and vegetables	Grain	Livestock
1922	7	85	106	70	154
1923	9	57	101	32	59
1924	3	19	58	15	36
1925	4	5	4	2	5

This apparent increase represented in part the inclusion in the Department's records of associations organized in earlier years. Since 1925, it is stated by an especially well-informed representative of the United States Department of Agriculture, there has been little, if any, net increase in the number of farmers' co-operative associations. The tendency instead has been toward the organization of larger associations and federations.

The estimated amount of business handled by the co-operative associations in the various trades in 1925 and in 1927 was as shown in Table 24.

TABLE 24.—CO-OPERATIVE MARKETING ASSOCIATIONS, BY COMMODITIES[a]

Commodity	Number of associations, 1925	Estimated number of members, 1925	Estimated amount of business	
			1925	1927
Grain	3,338	520,000	$750,000,000	$680,000,000
Dairy products	2,197	460,000	535,000,000	620,000,000
Livestock	1,770	400,000	320,000,000	320,000,000
Fruits and vegetables	1,237	180,000	280,000,000	300,000,000
Cotton	121	300,000	150,000,000	97,000,000
Tobacco	24	300,000	90,000,000	22,000,000
Poultry products	71	50,000	40,000,000	40,000,000
Nuts	39	20,000	16,000,000	14,600,000
Wool	91	50,000	10,000,000	7,000,000

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[a] R. H. Elsworth, "Agricultural Co-operative Associations," United States Department of Agriculture, *Technical Bulletin* No. 40, Washington, 1928, pp. 22, 27, 29, United States Department of Agriculture, *Agricultural Co-operation*, October 27, 1928, p. 425 The lower figures for 1927 were in several instances the result of lower prices. The discrepancy between the figures in this table and those in Table 22 for number of associations is explained by the fact that the estimates in Table 24 included associations not reporting to the Department of Agriculture.

Dairy.—One of the large groups of farmers' co-operative societies comprises associations handling dairy products—that is, those operating cheese factories, creameries, fluid milk plants, cream pools, plants for condensing milk and making ice cream, associations for distributing milk at wholesale and retail, and associations for bargaining on the price at which milk is to be sold by the farmers.

It was estimated by the United States Department of Agriculture that approximately 11,000,000,000 pounds of fluid milk were marketed through co-operative associations in 1927.[41] This quantity, it was stated, represented nearly one-fifth of the estimated quantity of fluid milk used in the continental United States for household purposes in that year. About 60 per cent of the milk classed as having been marketed co-operatively was under the control of bargaining associations, which did not actually engage in commercial transactions. The remaining 40 per cent was marketed by operating associations which assembled, processed, and delivered milk to consumers, such as hotels, restaurants, and private families.

One of the large milk associations is the Dairymen's League Co-operative Association (Inc.), furnishing milk at wholesale for metropolitan New York. Its sales in 1922–23 were 3,735,998,307 pounds of milk; in 1926–27, 2,224,220,066 pounds. The value of the milk sold by this association was $82,130,902 in 1922–23 and $79,452,617 in 1927–28.[42] The association at the outset engaged extensively in the manufacturing and selling of by-products for which the surplus milk was used during the season of heavy production. In 1925, the Dairymen's League Co-operative Association (Inc.) transferred a substantial part of its by-product business to The Borden Company.[43] The Twin City Milk Producers' Association, St. Paul, in 1922 had sales of $4,313,275 and in 1926, $8,464,354.[44] This association manufactures its surplus into butter, cheese, milk powder, condensed milk, ice cream, and casein. In several other districts also, co-operative associations have been successful in stabilizing the fluid milk business by aiding in the adjustment of production to demand, by stimulating improvements in quality, and by sales promotion methods.

One of the unsuccessful co-operative milk associations was the Oregon Dairymen's Co-operative League, which was organized in 1917 for supplying milk to the Portland market, and reorganized in 1920 for the purpose of controlling the dairy industry of the state.[45] At the end of 1921, steps were taken to wind up the business of the association. Numerous reasons were given for its failure, including defects in organization and poor management. It was stated, further, that the efforts of the league to keep surplus milk off the Portland market were frustrated by the construction of hard-surfaced roads which had greatly increased the area from which milk could be shipped in and thus caused a surplus at all seasons of the year.

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[41] United States Department of Agriculture, *Agricultural Co-operation*, May 26, 1928, p. 205.

[42] *The Dairyman's League News*, June 29, 1928, p. 18.

[43] *Printers' Ink*, January 29, 1925, pp. 53–55.

[44] United States Department of Agriculture, *Agricultural Cooperation*, January 22, 1927, p. 25.

[45] *Ibid*, February 12, 1923, pp. 5, 6.

Another dairy enterprise in which the co-operative type of organization has flourished is cheese making. It is stated that in 1926 approximately one-third of the cheese produced in the United States was marketed through 793 co-operative associations in 21 states, with sales amounting to 139,112,879 pounds of cheese. Seventy-five per cent of this cheese was made in Wisconsin; 6 per cent in Oregon; 5 per cent in Minnesota; and 4 per cent in New York.[46]

The Wisconsin Cheese Producers' Federation, formerly known as the National Cheese Producers' Association, in 1928 had 299 member factories located in Wisconsin and Minnesota. The sales of this association increased from 18,646,263 pounds in 1922 to 35,650,849 pounds in 1927; the value of these sales increased from $3,790,219 to $8,553,483 during the same period.[47] The sales of this association represented approximately 5 per cent of the total quantity of cheese produced in the United States in 1922 and a somewhat higher percentage in 1927.

The Land O'Lakes Creameries (Inc.), which started in 1921 under the name of the Minnesota Co-operative Creameries Association (Inc.), was organized for furnishing field service and for arranging for car-lot shipments. In 1923 it began the co-operative purchase of creamery and dairy supplies and in 1924 undertook the sale of butter and other dairy products, thus becoming an operating organization. This association was a federation of local co-operative creamery associations. It adopted and advertised a trade-mark—"Land O'Lakes"—for high-quality creamery butter and subsequently the name of the association was changed to Land O'Lakes Creameries (Inc.). The total sales of this association in 1927 amounted to $46,315,079.[48] The association marketed not only butter but also cheese, buttermilk powder, sweet and frozen cream, milk powder, milk fat, eggs, and poultry. The association made sales to wholesalers, chain store companies, and milk companies. In 1928 it was supplying butter under its trade-mark to a dozen or more of the large chains of retail grocery stores. Its market extends into the eastern and southern states. One of the most noteworthy accomplishments of this association has been a substantial increase in the proportion of high-grade butter manufactured by its members.

The Challenge Cream and Butter Association, a sales agency which marketed the products of 11 co-operative creamery associations in California, whose total sales increased from $5,011,591, in 1922[49] to

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[46] *Ibid*, March 31, 1928, p 125.
[47] *Ibid*, March 3, 1928, p. 81.
[48] *Ibid*, May 26, 1928, p. 206.
[49] *Ibid*, February 15, 1926, p. 73.

$15,955,033 in 1927,[50] in September, 1928, affiliated with the Land O'Lakes Creameries (Inc.), thus making the latter one of the largest single distributors of milk powder in the United States. The rapid growth of these large-scale co-operative enterprises in the dairy industry was strongly in contrast to the showing made by the large scale associations in several other trades.

Fruits and Vegetables.—The fruit industry furnishes some of the outstanding examples of successful co-operative marketing of agricultural products. The California Fruit Growers' Exchange is one of the oldest of these associations. Its sales, as shown in Table 25, increased from $55,271,975 in 1923 to $85,295,840 in 1927.

TABLE 25.—CALIFORNIA FRUIT GROWERS' EXCHANGE—SHIPMENTS[a]

Season ending Oct 31—	Oranges and grapefruit	Lemons	Total	Total sales
	Boxes	*Boxes*	*Boxes*	
1923	14,645,070	3,212,347	17,857,417	$55,271,975
1924	14,800,069	4,588,211	19,388,280	50,508,184
1925	11,967,715	4,176,677	16,144,392	70,236,507
1926	15,485,011	4,819,724	20,304,735	70,744,727
1927	17,815,857½	4,450,754½	22,266,612	85,295,840

[a] Compiled from Annual Reports

The shipments by the exchange constituted 68.7 per cent of the cars of citrus fruit shipped from California in 1922 and 71.5 per cent of the cars shipped from that state in 1927.

The California Fruit Growers' Exchange began advertising in 1907 on a small scale. The advertising has been continued in increasing volume. In 1927, the advertising and sales promotion expenditures of the exchange amounted to approximately $700,000. This was equivalent to 82/100 of 1 per cent of the sales of the exchange.[51] In addition to advertising in magazines and newspapers, in 1922 the company introduced the Sunkist electric juice extractor for use at soda fountains. In the annual report of the general manager of the exchange for 1927, it was stated that the number of extractors in use had increased to 41,614 and that the Sunkist extractors represented an annual consumption of 2,080,700 boxes of citrus fruit. The total selling and advertising expenses of the exchange, in percentage of the delivered value of the goods sold, were as follows: In 1922, 1.69 per cent; 1923, 2.49 per cent; 1924, 3.04 per cent; 1925, 2.40 per cent; 1926, 2.48 per cent; 1927, 2.41 per cent.

The Florida Citrus Fruit Exchange, organized on a plan similar to that of the California Fruit Growers' Exchange, reported annual shipments of 5,205,510 boxes of fruit in 1922-23; 3,958,572 boxes in 1925-26; and 4,440,030 boxes to May 10, 1927 [52]

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[50] Annual Report.

[51] Annual Report, 1927.

TABLE 26.—CALIFORNIA PRUNE AND APRICOT GROWERS' ASSOCIATION—RECEIPTS

Year	Prunes	Apricots	Pits	Percentage of California crop	
				Prunes	Apricots
	Pounds	*Pounds*	*Pounds*	*Per cent*	*Per cent*
1922	144,538,800	14,540,802	5,237,276	56	47
1923	137,694,938	24,690,557	6,447,669	52	41
1924	121,747,559	7,704,182	2,196,243	44	24
1925	138,100,257	6,811,499	1,588,735	47	19
1926	128,149,097	6,138,311	1,755,494	46	18
1927	105,737,772	10,192,464	....	.	..

The California Prune and Apricot Growers' Association was organized in 1921. Table 26 shows receipts[53] of the association. This association experienced a decline in receipts in 1923 and 1924, but a revival in 1925, following a reorganization which was necessitated by the slump in prices that occurred on a large carry over. During 1926 and 1927, the association carried on an extensive advertising and sales promotion program. In 1928 a second reorganization occurred.[54]

The California Associated Raisin Co., which was organized in 1912, controlled the bulk of the raisin output of the state. During the period of high prices, the production of raisins increased and, as a result, this association was hit particularly hard by the crisis of 1920. The price per pound fell from 13 cents in 1920 to 3¼ cents in 1922. The association had agreed in its contract to pay at least 4 cents a pound to its members. The result of the drop in prices, therefore, was a loss of $4,225,000.[55] In 1922 the name was changed to the Sun Maid Raisin Growers and in 1923 the association was reorganized. The sales of the association since 1922 have been as follows: 1922, $30,830,087; 1923, $19,632,805; 1924, $24,119,172; 1925, $20,397,184; and 1926, $19,978,137.[56] The association has organized two subsidiaries; one for carrying on processing and handling operations; the other, the Sunland Sales Co-operative Association, for marketing. The association has introduced the five-cent package of raisins and has made other merchandising innovations. It has carried on an extensive advertising and sales promotion program.

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[52] United States Department of Agriculture, *Agricultural Co-operation*, July 9, 1927, p. 259.

[53] *Ibid*, July 9, 1927, p. 261. The 1927 figures are from *Sunsweet Standard*, May, 1928, pp. 10, 18.

[54] *Sunsweet Standard*, July, 1928.

[55] R. B. Forrester, *Report upon Large Scale Co-operative Marketing in the United States of America*, Ministry of Agriculture and Fisheries London, 1925, p. 48.

[56] *Poor's Manual of Industrials*, 1927.

The association also has embarked upon an extensive program for promoting sales of its raisins in foreign countries.

The American Cranberry Exchange is a sales agency for the co-operative marketing of cranberries grown in Massachusetts, New Jersey, and Wisconsin. The sales of the exchange were as follows: 1922–23, 373,315 barrels; 1923–24, 390,976 barrels; 1924–25, 360,383 barrels; 1925–26, 314,083 barrels;[57] 1926–27, 461,278 barrels,[58] 1927–28, 288,326 barrels. In 1922–23, the shipments of the association amounted to 66 per cent of the commercial cranberry crop of the United States and in 1927–28 to 63 per cent. The association not only has provided for inspecting, crating, and standardizing shipments, but it also has advertised extensively. The expenditures for advertising which was undertaken in order to assist in marketing the bumper crop in 1926 amounted to $222,007. This is another example of the extent to which farmers' co-operative associations have become large-scale business enterprises, utilizing extensive advertising and sales promotion methods comparable to those of large private corporations.

In the marketing of vegetables there are various co-operative associations, most of which are small. Large-scale co-operative marketing has been attempted in the potato trade, but without universal success.

The Eastern Shore of Virginia Produce Exchange handles from 70 per cent to 80 per cent of the business in the district covered.[59] The chief business of the exchange is in white and sweet potatoes, but it also sells cabbage, strawberries, onions, and miscellaneous vegetables. Its sales in 1922 were $9,511,124; in 1923, $11,409,195; in 1927, $9,997,464.[60] In 1925 and 1926 the association experienced a loss because of low prices, but thanks to the financial policy which had resulted in the accumulation of a heavy reserve fund, the association was not embarrassed, and in 1927 it was again able to pay substantial patronage dividends to its members.

The Maine Potato Growers' Exchange had sales amounting to $3,283,884 in 1924–25.[61] In that year, however, the association was wrecked by the bumper crop which was produced not only in Maine but in other potato-growing states. The large crop resulted in a decline in prices and financial embarrassment to the farmers which the association was unable to avert. The Minnesota Potato Growers' Exchange met the same fate. The Colorado Potato Growers' Exchange, organized in 1923, made shipments amounting to 5,006 cars in 1923–24, and 5,269 cars in 1926–27.[62] The Michigan Potato Growers' Exchange, organized in 1918, increased its shipments from 2,439 cars in 1921–22 to 3,013 cars in 1926–27. These shipments constituted 16 per cent of the total shipments of potatoes from Michigan in 1921–22 and 21 per cent in 1925–26.[63]

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[57] United States Department of Agriculture, *Agricultural Co-operation,* June 9. 1928, p. 231.

[58] *Ibid,* June 25, 1927, p. 238.

[59] *Co-operation in the United States,* Grain Dealers' National Association, Toledo, 1925, p. 18.

[60] United States Department of Agriculture, *Agricultural Co-operation,* February 4, 1928, p. 37.

[61] *Ibid,* September 28, 1925, p. 401.

Grain.—As was indicated by Tables 22 and 23, there are more farmers' co-operative associations in the grain trade than in any other trade, and their sales constitute the largest aggregate volume among the co-operative groups. The co-operative associations in the grain trade are of several types: (1) farmers' elevators; (2) large-scale organizations composed of (*a*) farmer-owned lines of elevators, (*b*) state or regional pools, (*c*) terminal sales agencies.

The estimated sales of grain by 3,330 farmers' elevators in 1926–27 were as follows: wheat, 213,000,000 bushels; corn, 152,500,000 bushels; oats, 98,500,000 bushels; barley, 16,500,000 bushels; flax, 9,000,000 bushels; rye, 8,500,000 bushels; other grains, 2,000,000 bushels.[64] The sales by the nine wheat pools active in 1926–27 amounted to 17,500,000 bushels. In addition, some wheat was marketed by co-operative terminal sales agencies which came from other sources than the associations enumerated. Thus the total co-operative sales of wheat were estimated to amount to 27.7 per cent of the total wheat produced in the United States in 1926.[65] Inasmuch as only 580,000,000 bushels were shipped out of "counties where grown,"[66] the sales by the co-operative associations represented approximately 40 per cent of the 1926 wheat crop which entered into commercial channels. It has been estimated that the proportions which the co-operative associations handled of the quantities of other grains entering commercial channels in 1926 were as follows: corn, 26.3 per cent; oats, 35.9 per cent; rye, 20.8 per cent; barley, 29.5 per cent; and flax, 46.5 per cent; total for all grains, about 33 per cent.

The data just cited indicate that in 1926–27 the local co-operative elevators and farmer-owned line companies handled over 12 times as much wheat as was handled by the pools. Information received by the United States Department of Agriculture indicates that the estimated sales by the farmers' elevators amounted to approximately $750,000,000 in 1921, $754,000,000 in 1924, and $733,000,000 in 1926–27. Those figures include sales of both grain and side lines.

Table 27 shows the sales by the wheat pools as compared to the total United States production from 1921 to 1926.

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[62] *Ibid*, December 10, 1927, p. 478.

[63] *Ibid*, September 17, 1927, p. 360.

[64] *Ibid*, May 12, 1928, p. 185.

[65] *Ibid*, May 12, 1928, p. 185.

[66] United States Department of Agriculture, *Yearbook of Agriculture*, 1927, p. 750.

TABLE 27.—SALES BY WHEAT POOLS COMPARED TO TOTAL UNITED STATES PRODUCTION

Year	Total United States production[a]	Number of associations[b]	Marketed by centralized co-operative associations[c]	Per cent of total production
	Bushels		*Bushels*	
1921–22	814,905,000	3	11,374,370	1 4
1922–23	867,598,000	11	21,876,539	2 5
1923–24	797,394,000	12	27,144,055	3 4
1924–25	864,428,000	10	27,907,577	3 2
1925–26	676,429,000	9	16,823,560	2 5
1926–27	831,040,000	9	[b]17,500,000	2 1

[a] United States Department of Agriculture, *Yearbook of Agriculture*, 1927, p 739

[b] United States Department of Agriculture, *Agricultural Co-operation*, August 6, 1927, p 297

[c] R. H. Elsworth, "Agricultural Co-operative Associations," United States Department of Agriculture, *Technical Bulletin* No 40, Washington, 1928, pp 47, 48.

The wheat pools which were operated by the associations in the Pacific Northwest, starting in 1920, were not successful, and in 1924 the last of the state pools in that section disbanded and the Northwest Wheat Growers' Associated went out of business.[67] The California association also went out of business in 1924.[68] Wheat pools continued to operate in the soft wheat district of the Central States, in Kansas, Minnesota, Nebraska, North Dakota, Oklahoma, South Dakota, and Texas. These pools experienced varying degrees of stability and success. One of their main purposes was to secure "orderly marketing," usually by attempting to hold wheat off the market in the hope of obtaining prices that were deemed satisfactory.

The United States Grain Growers (Inc.), a terminal sales agency, organized in 1921 when the severe drop in prices was impending, became defunct in 1924. Various other farmer-owned sales agencies have been established[69] and their sales have been reported to have been as follows: 1924–25, $21,446,564; 1925–26, $14,664,333; 1926–27, $22,819,637; 1927–28, $35,623,237.

At the present time, the local farmers' elevators seem to be holding their own in respect to the volume of business handled. Diversification of production is tending to decrease the volume of grain marketed, but this is being partially offset by increases in the volume of sales of side lines. The large-scale pooling organizations, in contrast, have been losing ground in the grain trade, and, while the farmer-owned terminal sales agencies have shown an increase in volume handled, the strength of the co-operative movement among the grain farmers still lies with the local associations.

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[67] A. C. Adams, "History and Status of Wheat Pools in the Northwest," *American Co-operation*, Vol. II, Washington, D.C., 1926, pp. 603–16.

[68] R. H. Elsworth, "Agricultural Co-operative Associations," United States Department of Agriculture, *Technical Bulletin* No. 40, Washington, 1928, p. 48.

[69] *Ibid.*

Livestock.—In the livestock trade there are two chief types of associations; one, the local co-operative shipping association, and the other, the terminal co-operative sales agency. The terminal sales agencies sell not only for such local associations as are members but also for farmers who are not members of local associations. There are approximately 4,500 co-operative livestock shipping associations in the United States. Data are not available from all these associations, but according to the United States Department of Agriculture, in 1927, 1,980 local associations handled $239,891,000 worth of livestock.

The growth of the terminal co-operative sales agencies has been notable in this trade during the last few years. The largest of the terminal sales agencies is the Central Co-operative Association at South St. Paul, Minn.[70] Its sales increased from $4,887,293 in 1921 to $21,756,805 in 1922 and $40,908,879 in 1926. The total quantity of livestock handled in 1926 was 1,556,478 head. This represented 26.2 per cent of the market receipts at South St. Paul.[71] The Chicago Producers' Commission Association increased its sales from $6,383,313 in 1922 to $26,815,250 in 1926. Its sales in 1926 amounted to 6.2 per cent of the total market receipts in Chicago.[72] The sales of the Producers' Live Stock Commission Association, East St. Louis, Ill., increased from $9,704,023 in 1922 to $27,214,576 in 1926. Its sales in 1926 constituted 16.5 per cent of the market receipts at East St. Louis.[73] The sales of the Producers' Co-operative Commission Association at East Buffalo, N. Y., increased from $1,730,536 in 1922 to $10,718,925 in 1926 and its sales in the latter year were equal to 21.8 per cent of the total market receipts.[74] Although at least five similar agencies, which had been organized from 1916 to 1924, had been disbanded, 25 of these agencies were operating at 19 terminal markets in 1926.[75] The terminal commission agencies in operation in 1926 handled 10,660,569 head of livestock, valued at $295,098,736.[76] Their most rapid growth occurred from 1922 to 1924.

Another significant development in the livestock business, during the last few years, has been the direct selling and shipping of hogs to packers by local shipping associations. In 1925, 25 per cent of all hogs marketed in this country were sold direct to packers. In 1927, approximately one-third of all hogs marketed were either sold locally to packer representatives or consigned to packing plants located at terminal markets or adjacent to them. Numerous livestock shipping associations sell all their hogs direct to packers.

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[70] C. G. Randell, "Co-operative Marketing of Livestock in the United States by Terminal Associations," United States Department of Agriculture, *Technical Bulletin* No. 57, Washington, 1928, p. 62.

[71] *Ibid.*, pp. 96–97.

[72] *Ibid*, p. 68.

[73] *Ibid*, pp. 65–66.

[74] *Ibid*, p. 72.

[75] *Ibid*, p. 2.

[76] *Ibid*, p. 5.

A second recent and important development in the livestock trade is a movement among Corn Belt feeders and ranchmen in the West and Southwest to establish closer trading relations, whereby stocker and feeder cattle and lambs are sold directly by the ranchmen to the feeders. During the last three years, an increasing proportion of stocker and feeder animals have been purchased on the range and moved direct to feed-lots without going through central markets. The terminal livestock sales agencies have had a prominent place in facilitating these transactions by organizing pools. In 1925 they established the first stocker and feeder pool and handled 3,400 cattle in that manner. In 1928 these associations, through their pools, moved over 25,000 cattle and 75,000 lambs direct from the range to feed-lots in the Corn Belt. Thus these associations have found means of improving marketing methods in their industry.

Cotton.—In the cotton trade, the number of co-operative associations is much smaller than in the grain, dairy, livestock, and fruit and vegetable trades. Since 1920, the small local associations of cotton growers have been supplanted largely by large-scale associations, usually organized by states. Many of these large-scale associations are federated under the name of the American Cotton Growers' Exchange. In 1921–22, 5.3 per cent of the cotton crop was marketed by these large-scale associations; in 1922–23, 7.4 per cent; in 1923–24, 8.9 per cent; in 1924–25, 8 per cent; in 1925–26, 9.1 per cent; and in 1926–27, 6.7 per cent.[77] A decline in the percentage of the crop handled by these associations occurred in every state excepting Louisiana in 1926–27.

With the exception of the Staple Cotton Co-operative Association, which had attained a strong, constructive position in the trade in long staple cotton grown in the lower Mississippi Valley, the large-scale co-operative associations of cotton growers did not prove their permanency during the period under review. Their attention for the most part was focused on price, and little economic improvement was effected, for example, in baling cotton, where heavy waste still occurs, or in other methods of handling the trade. The farmers, furthermore, in numerous instances did not find it satisfactory to await the settlement of the pools to learn what their income was to be; they preferred, or were obliged, to sell to merchants for cash.

There are some indications that the cotton co-operatives may firmly establish themselves, as a result of new methods with which they are experimenting. The American Cotton Growers' Exchange since 1926 has maintained a research division, primarily for studies of price trends and relationships, which also is giving attention to the improving and standardizing of the business practices of state associations. The co-operatives have modified their selling policies so that they now sell on practically any terms desired by buyers. Short-time pooling arrangements have been worked out which enable members to obtain payment almost as soon as the cotton is delivered. Co-operative gins have been established by three state associations, to aid in maintaining purity of seed and in effecting better ginning and baling. The credit situation has been helped in some instances by the establishment of credit corporations with the aid of the co-operatives. Some savings have been effected for members in interest charges and in cost of insurance and warehousing. By drawing only one sample from a bale, whereas several samples are pulled from each bale under the traditional methods of marketing, the co-operatives also effect savings. Opportunities for constructive service unquestionably exist in the raw cotton trade, but it remains to be seen whether the co-operative associations will have the strength and the foresight to utilize them for carrying out broad-gauge, constructive programs which will yield substantial economic gains.

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[77] R. H. Elsworth, "Agricultural Co-operative Associations," United States Department of Agriculture, *Technical Bulletin* No. 40, Washington, 1928, p. 35.

Wool.—The quantity of wool handled by co-operative associations (Table 28) in the United States increased from 10,558,283 pounds in 1922 to approximately 25,611,055 pounds in 1926, followed by a decline to 15,755,305 pounds in 1927.

TABLE 28.—CO-OPERATIVE SALES OF WOOL

Year	Total United States production of fleece wool[a]	Wool handled by co-operative associations[b]	Per cent of total production
	Pounds	*Pounds*	
1922	221,713,000	10,558,283	4.8
1923	225,696,000	18,799,678	8.3
1924	235,575,000	17,167,974	7 3
1925	245,562,000	25,184,587	10.3
1926	260,976,000	25,611,055	9.8
1927	272,453,000	15,755,305	5.8

[a] United States Department of Agriculture, *Yearbook of Agriculture*, 1926, p. 1131.

[b] Data furnished by United States Department of Agriculture.

In the wool trade, as in the grain trade, state pools have been tried during recent years. The Pacific Co-operative Wool Growers, which in June, 1927, had 2,400 members from eastern Oregon, eastern Washington, and Idaho, was performing the services of classing, grading, financing, sorting, scouring, and selling wool for its members, chiefly direct to mills. The sales of this association increased from 1,500,028 pounds in 1921–22 to 6.097,159 pounds in 1925–26[78] The Ohio Wool Growers' Co-operative Association increased its sales from 2,725,000 pounds in 1922[79] to 3,138,849 pounds in 1927.[80] The National Wool Warehouse and Storage Co., which was formed in 1909, went out of existence when it completed the marketing of the 1924 clip. The cause for its failure was financial embarrassment resulting from overadvances to members on wool in 1920.[81] The co-operative associations have not yet become a major factor in the wool market, except in a few districts.

Tobacco.—Table 29 shows the total production of tobacco and the quantity marketed by large-scale co-operative associations from 1921 to 1926 It is to be noted that there was a marked decline in 1924–25 in the receipts by the large-scale marketing associations in the tobacco trade.

TABLE 29 —COMPARATIVE MARKETING OF TOBACCO

Year	Total United States production[a]	Received by large-scale tobacco marketing associations	
		Quantity[b]	Per cent of total production
	Pounds		
1921–22	1,069,693,000	129,414,613	12 1
1922–23	1,246,837,000	607,843,756	48 8
1923–24	1,515,110,000	699,864,889	46 2
1924–25	1,251,343,000	429,576,392	34 3

[a] United States Department of Agriculture, *Yearbook of Agriculture*, 1926, p 1024

[b] R H Elsworth, "Agricultural Co-operative Associations," United States Department of Agriculture, *Technical Bulletin* No 40, Washington, 1928, p 61.

The largest and, with one exception, most successful of the co-operative associations of tobacco growers is the Burley Tobacco Growers' Co-operative Association, which was organized in 1921. Its receipts and sales from 1921 to 1926 are shown in Table 30.

The association experienced difficulty in marketing the 1923 crop, which was large and of poor quality. The final payments to members on that crop were not made until December, 1927.[82] The association, from 1921 to 1925, undertook to hold tobacco off the market until satisfactory prices were secured. In the autumn of 1926 a new plan was announced, in which the association arranged for the sale of tobacco at auction.[83]

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[78] Approximate figures, United States Department of Agriculture, *Agricultural Co-operation*, June 7, 1926, p 246.

[79] *Ibid*, March 19, 1927, p. 106.

[80] *Ibid*, February 4, 1928, p 44.

[81] United States Department of Agriculture, *Co-operative Marketing of Wool*, 1920–1926, p. 7.

[82] United States Department of Agriculture, *Agricultural Co-operation*, December 24, 1927, p. 504.

[83] *Ibid*, November 22, 1926, p. 469.

TABLE 30.—RECEIPTS AND SALES OF THE BURLEY TOBACCO GROWERS' CO-OPERATIVE ASSOCIATION[a]

Crops	Pounds received	Sales
1921	119,914,613	$26,271,514
1922	197,009,743	52,218,341
1923	245,443,006	[b]48,882,697
1924	171,403,690	[b]35,983,065
1925	135,574,125	[b]25,473,568
1926	[c]118,359,923	

[a] United States Department of Agriculture, *Agricultural Co-operation*, December 6, 1926, p. 489

[b] Including inventories as estimated August 31

[c] *Ibid*, May 28, 1927, p. 209

The association thus adopted a plan similar to the loose leaf auction sales which had been condemned by the promoters of the association in 1921 as being thoroughly unsound. The managers of the association, however, stated that the results of the sale at auction in 1926 were not satisfactory.[84] In 1927, an effort was made to induce growers to sign a new seven-year contract which would permit the marketing of tobacco by private sale rather than by auction, provided a 75 per cent sign-up could be secured.[85] The association did not secure a 75 per cent sign-up, however, and early in 1928 the association was operating its warehouses for the sale of tobacco for members and other growers at loose leaf auctions.[86]

The Northern Wisconsin Co-operative Tobacco Pool was organized in 1922 on a five-year contract and began operations in 1923. The deliveries by members to the association amounted to 30,631,245 pounds in the season 1922–23, 31,049,418 pounds in 1923–24, and 15,577,078 pounds in 1924–25.[87] The association encountered difficulties during the early years because of the low quality of successive crops. Nevertheless it accomplished sufficiently satisfactory results to induce growers producing upwards of 20,000,000 pounds a year to sign contracts for a second five-year period beginning in 1927. The association established a grading system, whereas none had existed previously in that market, and checked the dumping of tobacco on the market.[88] It also placed itself in a strong financial position by accumulating reserves against various contingencies.

The Connecticut Valley Tobacco Association was organized in 1922 with a five-year contract with members. Its receipts in 1922–23 were 26,901,714 pounds of tobacco; in 1923–24, 35,311,079 pounds; in 1924–25,

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[84] *Ibid*, May 28, 1927, p. 209.

[85] *Ibid*, October 1, 1927, p. 387.

[86] *Ibid*, February 4, 1928, p. 44.

[87] *Ibid*, May 10, 1926, p. 204.

[88] *Ibid*, September 28, 1925, p. 411.

30,733,017 pounds; and in 1925–26, 26,428,254 pounds.[89] To assist in financing the association, $8,000,000 was subscribed by a syndicate of 47 New England and New York banks in 1923.[90] This association, like the Burley Tobacco Growers' Co-operative Association, undertook to carry over part of the crop in the early years in the hope of securing better prices. The delay in making payments to members caused dissatisfaction, and the maintenance of artificially high prices, together with a tendency for the demand for cigars to decline, resulted in overproduction [91] In March, 1927, it was decided to disband the association.

The Dark Tobacco Growers' Co-operative Association was organized in 1922. At the outset it had 57,000 members which were expected to give control of 66 per cent of the crop.[92] Less than 50 members were delinquent in the delivery of the 1922–23 crop and the association received 175,000,000 pounds out of the total production of 303,000,000 pounds. The price was maintained at an abnormally high point by carrying over 20 to 25 per cent of the tobacco received. Dissatisfaction was caused by the delay in payments, and violation of contracts by members were numerous when the time came for delivering the 1923–24 crop. The crop of that year was of poor quality and large in volume. Again tobacco was carried over and payments to members were postponed in order to hold up prices. This caused so great discontent that the deliveries for the 1924 crop dropped to 90,000,000 pounds. In October, 1925, the growers were released from their contracts and the association handled no tobacco of the 1925 crop. In 1926 the association received voluntary deliveries of 49,000,000 pounds.

The Miami Valley Tobacco Growers' Association was organized in 1923, but went out of business in 1926. It handled 19,742,000 pounds of the 1923–24 crop and 5,051,622 pounds of the 1924–25 crop.[93]

The Tobacco Growers' Co-operative Association, Raleigh, N. C., was organized in 1922. Its receipts for the season of 1922–23 amounted to 163,589,034 pounds of tobacco; for 1923–24, 180,135,838 pounds; for 1924–25, 103,821,150 pounds; and for 1925–26, 83,480,539 pounds.[94] In June, 1926, receivers in bankruptcy were appointed for liquidation.[95] In this case it was stated that the managers of the association were dishonest.[96]

[89] *Ibid*, August 16, 1926, p. 344.

[90] *Ibid*, January 2, 1923, p. 10.

[91] *Ibid*, September 14, 1925, p. 386.

[92] J. W. Jones, "Some Causes of the Difficulties of the Dark Tobacco Association," *American Co-operation*, Vol. I, Washington, 1927, pp. 60–72.

[93] R. H. Elsworth, "Agricultural Co-operative Associations," United States. Department of Agriculture, *Technical Bulletin* No. 40, Washington, 1928, p. 61.

[94] United States Department of Agriculture, *Agricultural Co-operation*, June 21, 1926, p. 267.

[95] *Ibid*, July 5, 1926, p. 287.

[96] Aaron Sapiro, "Dark and Bright Spots in Co-operative Marketing." *American Co-operation*, Vol I, Washington, 1926, p. 35.

During the period covered by this survey, one of the chief slogans of those interested in promoting co-operative marketing of agricultural products has been "orderly marketing." The record of the years from 1922 to 1927, however, do not indicate substantial accomplishments by large-scale co-operative enterprises in handling the staple crops, and the doctrine that marketing of staple agricultural commodities by the private firms is disorderly has not been proved. The theory back of the demand for "orderly marketing" is that prices are depressed by having a crop come on the market in large quantities during a short season of the year. No conclusive evidence has been found that such is the case, nor is it reasonable to expect prices to be depressed during the period of heavy crop movement. A flour miller, a cotton manufacturer, or a wool manufacturer, in determining the price at which to buy, takes into account the fact that the crop must suffice for an entire season, and in the large markets the only significance that is attached to the movement of the crop during the season is the indication that may be afforded regarding the total size of the crop. An effort is made constantly by merchants and manufacturers in respective trades to determine the price with reference to the entire crop season and not merely for the period during which it is moving to market. As a result, those large co-operative associations which have focused their attention chiefly upon withholding particular raw materials from the market, in the hope of securing better prices later have had little success, and, as in the case of various tobacco growers' associations, have sometimes experienced embarrassment.

The experiments of large-scale enterprises in co-operative marketing, which have been especially characteristic of the period from 1922 to 1927, show that success has been attained when the associations have been able to effect real economies in distribution, or where they have applied constructive methods of merchandising and sales promotion with avoidance of overproduction. It is by methods such as those associations have used, rather than by efforts at valorization, that large-scale co-operative enterprises have prospered.[97]

[97] Although consumers' co-operation is not so strong in America as in the countries of Europe, nor even so well established as the co-operative marketing movement among the farmers, nevertheless it does occupy a significant place in the lives of several hundred thousands of farmers and industrial workers. In 1928 there were approximately 1,700 co-operative store societies, the larger number of them in the rural districts, although the societies doing the largest business are situated in the cities. The biggest of all, in point of membership and turnover, is the Franklin Co-operative Creamery Association, distributor of milk and other dairy products to thirty or forty thousand consumers of Minneapolis. This organization has 5,000 shareholder members and annual sales in excess of $3,500,000. The Co-operative Trading Company of Waukegan, Ill., has sales of nearly $700,000 and distributes groceries, meats, its own bakery products, and milk. Consumers Co-operative Services of New York City, with more than 3,000 members, operates eight cafeterias and restaurants. The Soo Co-operative Mercantile Association, at Sault Sainte Marie, Mich., the largest

VI. INSTALLMENT SELLING

Regarding installment selling there are, unfortunately, relatively few facts which are not open to question. In 1926, Milan V. Ayres published an estimate of retail installment sales in 1925 and an estimate of the increase in the volume of outstanding installment debts from 1923 to 1925.[98] His estimate of the total volume of retail installment sales was $5,704,000,000, in 1925. In 1927, Professor Edwin R. A. Seligman published his two volume study on installment selling.[99] In that study Seligman discussed Ayres' estimates and made various revisions in them, with the result that he arrived at a figure of $4,875,000,000.[1] Both writers stated frankly, however, that on most points their estimates were only in the nature of intelligent guesses. In the present survey it has been possible to secure a further check on some items, and an attempt has been made to estimate the increase in the volume of installment selling which occurred from 1923 to 1927. These estimates are subject to a large percentage of error, but even within the limits of possible error it is believed that they have significance.

In making estimates of the increase in the volume of retail installment sales since 1923, use has been made of the estimates of Ayres and Seligman and of various indexes of the expansion or contraction of particular industries. The balance sheets of companies engaged in the production of goods sold on installment were examined and also the balance sheets

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business institution in the city, operates a bakery and a chain of eight retail stores which do a business of $650,000 annually. The Cloquet Co-operative Society of Minnesota has a membership of 1,300, composed of mill workers and farmers, and has a turnover of $550,000. There are co-operative bakeries owned and operated by consumers in 22 cities and towns throughout the country. The co-operative restaurant, cafeteria, and boarding house societies number 27. Ten co-operatives are distributing milk. Hundreds are handling gasoline and oil, and in several states wholesale oil companies have been formed by federations of these societies. Co-operatives are also engaged in a multitude of miscellaneous services, such as the distribution of coal, water power, telephone service, operations of book stores, etc. Federations of local consumers' societies have formed co-operative wholesales in Seattle, Wash., Superior, Wis., Omaha, Neb., and New York City. The Co-operative League of the U S A. is the central educational union for the movement, supported by its constituent membership It publishes a monthly magazine, conducts an accounting bureau, provides legal service to its members, sends out speakers and organizers, conducts a correspondence school and local resident training schools for employees and others, gets out a Co-operative Year Book and other publications, and conducts every second year a National Co-operative Congress. The League is the only member of the International Co-operative Alliance from the United States, and its President, Dr. James P. Warbasse, is on the Central Executive Committee of that body. Note by Harry W. Laidler, Director.

[98] Milan V. Ayres, *Installment Selling and Its Financing*, paper presented at the Third National Automotive Financing Conference, November 15–16, 1926.

[99] Edwin R. A. Seligman, *The Economics of Installment Selling*, 2 vols., New York, 1927.

[1] *Ibid*, vol. I, p. 117.

of such of the finance corporations as are publicly available. In a few instances helpful data were secured from those sources, but for the most part they proved barren.

The industry with the largest volume of installment sales is the automobile business. Ayres' estimate of installment sales for new cars in 1925 was $2,188,000,000, new trucks $454,000,000, used cars and trucks $881,000,000, making a total of $3,523,000,000 for all automobiles and trucks. Seligman, as a result of his investigations, reduced the estimate of the installment sales of all automobiles and trucks to $2,734,000,000 in 1925.[2]

Ayres estimated that, as a result of the decline in prices of automobiles, there was no increase in the volume of automobile installment paper outstanding in 1925 over 1923. The analysis made by Dr. Filipetti, as part of Seligman's study, showed that 45.8 per cent of the new cars sold by the General Motors dealers, from whom reports were obtained, were sold on installments in 1923, 50.7 per cent in 1924, 52 per cent in 1925, and 55.9 per cent in 1926.[3] For used cars, the installment sales in 1923 amounted to 54.8 per cent; in 1924, 57.4 per cent; in 1925, 62.8 per cent; and in the first six months of 1926, 65.2 per cent. These ratios related solely to the number of cars, whereas, in computing the value of the sales in dollars, Seligman used weighted ratios which showed that 59 per cent of the total sales of automobiles were on installments in 1925 and 57 per cent in 1926.[4]

C. C. Hanch, general manager of the National Association of Finance Companies, stated in November, 1927, that in 1927, 58 per cent of the new cars were sold on installments, as compared with 64 per cent in 1926, and that the percentage of all cars, new and used, sold on installments was 60.8 per cent in 1927, as compared with 70 per cent in 1926 and 75.5 per cent in 1925.[5] The percentage figure which Hanch gave for 1927 was approximately the same as the figure which Seligman used for 1925. Hanch stated further that used-car paper was 26.8 per cent of the total retail automobile notes purchased by finance companies in 1927, as compared with 33 per cent in 1926. He also stated that there had been a tightening of terms since 1924, when the practice became particularly common of accepting small initial payments and granting long terms. As a result of reports which he had received from numerous finance companies, he stated that retail automobile paper, calling for more than 12 monthly payments, had been reduced from 18.3 per cent in 1925 to 13.2 per cent in 1926 and 12.4 per cent in 1927, and that the volume of retail paper calling for less than the standard down payment of at least one-third of the cash price decreased from 19.4 per cent in 1925 to 9 per cent in 1926 and 5.2 per cent in 1927.

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[2] *Ibid,* Vol. I, p. 117.

[3] *Ibid,* Vol. II, p. 426.

[4] *Ibid,* Vol. I, p. 111.

[5] C. C. Hanch, *Composite Experience of Automobile Finance Companies,* release dated November 14, 1927.

This information regarding the practice of finance companies is significant, since over a period of years finance companies have been purchasing a larger and larger proportion of the installment notes taken by dealers, whereas previously the notes were discounted at commercial banks. John J. Schulmann, Jr., an officer of the General Motors Acceptance Corporation, stated, at the annual meeting of the National Association of Finance Companies in 1927, that a few years previously the General Motors Acceptance Corporation was financing 21 or 22 per cent of all the cars sold by its dealers, a ratio which represented about one-third of the cars sold on installments by the dealers. In 1927, the General Motors Acceptance Corporation, he stated, was financing approximately 36 per cent of all the cars sold by the dealers, or over 55 per cent of the cars that the dealers sold on installments.

In view of the foregoing evidence, some of which represents conflicting opinions, it has been deemed advisable to estimate roughly the change in installment sales of automobiles and trucks from year to year in the following manner. Seligman's estimate of the total sales of automobiles and trucks in 1925, of $2,734,000,000, was accepted as the base In order to obtain an index to the annual changes in the total volume of sales, the data in the *Survey of Current Business*, published by the United States Department of Commerce, on the sales of new passenger cars and motorcycles, were utilized. These figures, computed from the tax returns for domestic sales, were as follows: 1923, $2,125,600,000; 1924, $2,022,500,000; 1925, $2,239,700,000; 1926, $2,508,881,000; 1927, $1,990,444,000. These figures indicated an increase of 5 per cent in new car sales in 1925 over 1923, a 12 per cent increase in 1926, and a decline of 21 per cent in 1927. Assuming that the volume of installment sales for both new and used cars and trucks changed at the same rate, there was an increase of $130,000,000 in the installment sales of automobiles in 1925 over 1923, a further increase of $328,000,000 in 1926, and a decline in 1927 of $643,000,000 below the point reached in the preceding year. These figures probably are in excess of the net changes that actually occurred, since the prices of used cars were tending to decline, less liberal terms were being offered by the finance companies after 1924, and an opinion that deserves weight has been quoted to the effect that the percentage of cars sold on installments declined after 1925. The figures as given represent liberal estimates.

It appears, therefore, that the largest growth in the volume of installment sales of automobiles occurred prior to 1923. The offering of easier terms in 1924, and the subsequent efforts to stimulate the interest of manufacturers and merchants in other industries to sell on installments, probably reflected a tendency for the sales of automobiles on installments to slacken rather than a new discovery of the advantages of installment selling. In other words, the widespread discussion of installment selling after 1923 probably was stimulated, in part at least, by the efforts of the finance companies to expand their business in other directions as they found the resistance to installment sales of automobiles becoming greater.

For furniture, Ayres gave an estimate of installment sales of $700,000,000 in 1925. Seligman placed the figure at $850,000,000, on the ground that 80 per cent of the retail sales of furniture were made on installments. The 80 per cent ratio is doubtful, however, and in fact it is by no means certain that even so high a ratio as the 70 per cent used by Ayres was warranted. Seligman's elaborate compilation of credit ratios threw practically no light on installment selling because it included book credit as well as installment credit. In the large cities it is quite possible that 70 per cent or perhaps 80 per cent of the furniture is sold on installments, but in medium-size cities and smaller communities the volume of installment sales commonly is less.

Ayres estimated that there was an increase of 15 per cent in the volume of furniture paper outstanding in 1925 over 1923. This figure is judged to be too high. The data in the *Survey of Current Business* on shipments and plant operations of furniture manufacturers in the Grand Rapids district did not indicate any substantial change from 1923 to 1927. The figures for shipments of household furniture and case goods did indicate an increase, but the basis of the compilation was changed during the period, so that it cannot be taken as an accurate check.

For the purpose of this survey, annual figures for total sales and installment sales were obtained from five retailers, engaged primarily in the installment furniture business, with an aggregate volume of sales of $5,919,935 in 1927. These firms were representative and, although the sample was small, their figures are the only definite guide which is available regarding the change in the volume of installment sales of furniture. For these five firms, the installment sales in 1925 were 6 per cent greater than in 1923. In 1926 there was a further increase of 2 per cent and in 1927 a decline of 1 per cent.

In order to make a liberal allowance in arriving at a conclusion regarding the changes that occurred, it has been estimated that the installment sales of furniture in 1925 were somewhat over 10 per cent greater than in 1923, or roughly $70,000,000, that a further increase of $8,000,000 occurred in 1926, and that there was no substantial change in 1927.

For the piano business, Ayres estimated that there had been no increase in the volume of outstanding installment paper in 1925 as compared with 1923, and no evidence has been found to indicate any material increase since that time. It is agreed that 80 to 90 per cent of the pianos sold in the United States are paid for in installments, a ratio which obtained long before 1923

For phonographs, Ayres estimated an increase of 5 per cent in the volume of installment paper outstanding in 1925 over 1923, which would have amounted to $8,000,000. The sales of two of the large phonograph manufacturers, however, do not support such a conclusion. The sales of the Brunswick-Balke-Collender Co., both domestic and foreign, were $28,295,386 in 1923, $25,792,913 in 1924, $23,371,968 in 1925, $29,017,125 in 1926, and $27,891,919 in 1927. That company manufactures billiard tables and other products, as well as phonographs and combination phonograph and radio sets. The sales of the Victor Talking Machine Co. were $44,160,211 in 1923, $36,951,879 in 1924, $20,857,956 in 1925, $46,662,103 in 1926, and $46,886,842 in 1927. In the absence of evidence to the contrary, therefore, it is concluded that no allowance should be made for an increase in the installment sales of phonographs from 1923 to 1927.

Radio sets constitute another large item in the installment trade, but any estimate of this business is particularly difficult. Ayres placed the installment sales of radio sets in 1925 at $169,000,000, which was 75 per cent of the estimated total sales of radio sets amounting to $225,000,000. Seligman stated that the estimates of the Radio Manufacturers' Association for the volume of retail trade for 1925 were $175,000,000 and for 1926, $225,000,000, from which he concluded that Ayres' estimate was based on the 1926 figures rather than on the 1925 figures.[6] Ayres' estimate of an increase of 215 per cent in the volume of radio installment paper outstanding from 1923 to 1925 has, therefore, been spread over 1926 as well, and the estimate for the increase from 1923 to 1925 was placed at $76,000,000, the increase in 1926 at $39,000,000, and for 1927 a rough guess of a further increase of $40,000,000 was made.

For washing machines, Ayres gave an estimate of installment sales of $95,000,000 in 1925, with an increase of 16 per cent over 1923 in the volume of the installment paper outstanding. Instead of accepting the latter figure, the following method was used for estimating the increase in the volume of installment sales of washing machines. Ayres' estimate of $95,000,000 of installment sales in 1925, which Seligman agreed was fairly close, was accepted. As an index to the change in the volume of washing machine sales, the figures of the average monthly shipments published in the *Survey of Current Business* were utilized. These figures, it was stated, represented practically the entire industry. In 1923, the average monthly shipments were 46,197 machines; in 1924, 51,005 machines; in 1925, 61,073 machines; in 1926, 70,307 machines; and in 1927, 64,638 machines. These figures indicate that the sales in 1925 were 32 per cent greater than in 1923, 15 per cent greater in 1926

[6] Edwin R. A. Seligman, *The Economics of Installment Selling*, Vol. I, p. 107.

than in 1925, and 8 per cent less in 1927 than in 1926. Applying these ratios to Ayres' estimate of $95,000,000 in 1925, we have an increase of sales of washing machines on installments of $23,000,000 in 1925 over 1923, a further increase of $14,000,000 in 1926, and a decline of $6,000,000 in 1927.

For vacuum cleaners a similar method of computation was used. The average quarterly shipments of vacuum cleaners in 1923 were 254,075 machines; in 1924, 225,891 machines; in 1925, 239,463 machines; in 1926, 266,358 machines; and in 1927, 259,654 machines, according to data, published in the *Survey of Current Business*, which represented the bulk of the industry. Ayres' estimate of sales of vacuum cleaners on installments in 1925 was $51,000,000. This was somewhat larger than Seligman's estimate, but is used here in order to err on the side of liberality. Utilizing the data on shipments as an index to the volume of trade, it appears that there was a decline of $3,000,000 in the sales of vacuum cleaners on installments from 1923 to 1925, an increase of $6,000,000 in 1926, and a decline of $2,000,000 in 1927. For washing machines it was estimated that 90 per cent of all retail sales were made on installments, for vacuum cleaners 85 per cent, and for sewing machines 90 per cent.

Ayres estimated the total sales of sewing machines in 1925 at $100,000,000 and the installment sales at $90,000,000. He stated that the volume of sewing machine installment paper outstanding was 5 per cent greater in 1925 then it had been in 1923. This volume of sales of sewing machines on installments is a particularly troublesome one for which to get a satisfactory figure, even though the industry has been long established. During recent years there has been a marked increase in the sales of electric sewing machines, as was stated in the section on Changes in Demand. The estimate of the total retail sales of electric sewing machines by *Electrical Merchandising* was $10,000,000 in 1922 and $33,250,000 in 1927.[7] No data are available, however, for the changes in the volume of sales of foot-power machines. The sales of the Singer Sewing Machine Co. are not published. The sales of sewing machines by the White Sewing Machine Co., according to the company's annual reports, amounted to $4,478,841 in 1923, $5,763,936 in 1924, $8,334,219 in 1925, and $9,322,823 in 1926, but were not published for 1927.

The estimate which Ayres gave of $100,000,000 for the sales of sewing machines probably included the sales of sewing machines for use in garment factories and other manufacturing establishments as well as for household use. For want of a better guide, the retail sales of electric sewing machines, as given by *Electrical Merchandising*, have been utilized, and from them an inference has been drawn that the increased installment sales of sewing machines have amounted to about $5,000,000 a year since 1923. This is somewhat larger than Ayres' figure for the increase during the two-year period from 1923 to 1925.

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[7] See page 325.

Ayres' estimates were utilized for the increase in the installment sales of gas stoves, amounting to $2,000,000 from 1923 to 1925, and the same rate was used for 1926 and 1927.

The estimated retail sales of electrical refrigerators was placed by *Electrical Merchandising* at $4,000,000 in 1922 and $82,125,000 in 1927. Ayres placed the sales of all mechanical refrigerators at $15,000,000 in 1925, with an increase of 450 per cent in the volume of installment paper for that industry during the two preceding years. In the light of the estimates made by *Electrical Merchandising*, Ayres' estimate of the sales in 1925 was too low. Instead of accepting that estimate, a rough guess has been made that the increase in the installment sales of mechanical refrigerators amounted to $20,000,000 from 1923 to 1925, $30,000,000 in 1926, and $25,000,000 in 1927.

For the jewelry trade, Ayres estimated that 25 per cent of the jewelry sales were on installments. Seligman concluded that 25 per cent was too high. From ten years' experience with the retail jewelry trade, I am of the opinion that 25 per cent is too high a ratio and that Seligman's estimate of jewelry installment sales, which was about half that of Ayres, was more nearly correct. Ayres placed the increase in jewelry paper outstanding from 1923 to 1925 at 25 per cent. Installment firms in the jewelry business seem to have been more prosperous than the retail jewelers who were not selling on installment, but Ayres' estimate is sufficiently liberal. From consideration of these factors, the estimate for increase in the sales of jewelry on installments in 1924–25 has been placed at $12,000,000, for 1926 at $6,000,000, and for 1927 at $6,000,000. These estimates probably are somewhat exaggerated.

In the clothing trade it is necessary to make a differentiation between the sales of those firms which long have been doing an installment business and the sales of retailers who adopted the so-called "10-payment plan." The sales on the 10-payment plan represented the only substantial increase in installment business during recent years. There are grounds, furthermore, for not including the 10-payment sales under the heading of installment sales, because of the fact that the installment period was only 10 weeks and that the sales made on this plan largely took the place of book credit. Ayres placed the volume of sales of clothing on the 10-payment plan at $185,000,000 in 1925, which represented, according to his ratio of the increase in outstandings, an increase of $125,000,000 over 1923. This estimate is permitted to stand for the period from 1923 to 1925, although it is doubtful if the volume was as large. At all events, it can be stated safely that there has been no material increase in the volume of installment sales of clothing since 1925.

The next item on Ayres' list is property improvements. Utilizing Ayres' figures, there was an increase of $53,000,000 in installment sales of this character from 1923 to 1925. There may have been perhaps a further increase of $25,000,000 in 1926, but with no additional volume in 1927. This figure is merely a guess and is probably too high.

The sales of tractors, both for cash and on installments, were placed by Ayres at $95,000,000 in 1925 and the sales of other farm machinery at $280,000,000. By combining these figures, an estimate of $375,000,000 was obtained for the total sales of tractors and other farm machinery. For the combined group, Ayres estimated that 27 per cent was sold on installments.

Seligman stated that the sales of farm equipment on installments should not properly be included with the discussion of retail installment selling, on the ground that these were producers' goods. At this point, however, the economists' traditional distinction between consumers' goods and producers' goods breaks down, because, if Seligman were consistent, he would have eliminated the sale of motor trucks on the same ground that farm machinery was eliminated. From the marketing standpoint, furthermore, the methods of distribution of farm equipment are similar to the methods of distributing various types of consumers' goods, such as automobiles, and the marketing problems are far more analogous to other problems of marketing consumers' goods than they are to the marketing of industrial goods. It is for this reason that it has been found advisable to make a differentiation between consumers' goods and industrial goods and to include such items as farm equipment with consumers' goods for the purpose of marketing discussions.

The International Harvester Co. does not publish its annual sales, but, in its annual reports, the ratio of cash collections to total sales in the United States is given. For 1923, the cash collections amounted to 81 per cent of the sales; in 1924, 78 per cent; in 1925, 76 per cent; in 1926, 73 per cent; and in 1927, 72 per cent. Incidentally, it is of interest to note that in 1911 this ratio was 64.2 per cent.[8]

In 1922, the International Harvester Co. adopted a policy of offering more liberal credit terms to enable farmers to purchase new equipment more readily. This accounts for the decline in the ratio of cash collections to total sales from 1923 to 1927. The differences between the cash collections and total sales in 1925 was 24 per cent for the International Harvester Co., whereas Ayres' estimate of the sales of both tractors and farm equipment on installments amounted to 27 per cent of the total sales.

The policy of various manufacturers of farm implements has varied somewhat from company to company, in part probably because of differences in the strength of their respective financial resources. Nevertheless, it is probable that either the manufacturers or the retailers selling farm implements have had to make arrangements to meet approximately the International Harvester Co.'s practice. The increased sales of the International Harvester Co. on long-term credits may be taken as fairly indicative for the industry.

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[8] Federal Trade Commission, *Report on the International Harvester Co.*, Washington, 1913, p. 283.

Data are compiled by the Federal Reserve Bank of Chicago and published in its bulletin, and also in the *Survey of Current Business*, on the average monthly shipments of agricultural machinery and equipment. These figures are stated to represent 80 per cent of the industry. The relative domestic shipments of agricultural machinery and equipment, according to these figures, on the basis of the average of 1923–1925 = 100, were as follows: 1923, 92.5 per cent; 1924, 90.5 per cent; 1925, 117.1 per cent; 1926, 132.1 per cent; 1927, 137 per cent. By using Ayres' estimate of retail installment sales of tractors and other farm machinery amounting to $375,000,000, and making allowance for the increase in the total volume of sales and in the higher percentage of installment sales, it has been concluded that the installment sales of farm machinery were $34,000,000 greater in 1925 than in 1923; that in 1926 there was a further increase of $25,000,000; and in 1927 another increase of $9,000,000.

Increase in Volume.—The estimates of the increase in the volume of retail installment sales, therefore, stand as shown in Table 31. In this total, Ayres' estimates have been derived from his estimates of the

TABLE 31.—INCREASE IN VOLUME OF RETAIL INSTALLMENT SALES
(In millions of dollars)

	1925 above 1923		1926 above 1925	1927 above 1926
	Ayres' estimate	Revised estimate		
Automobiles		130	328	−643
Furniture	91	70	8	
Pianos		.		
Phonographs	8			
Radio sets	115	76	39	40
Washing machines	14	23	14	− 6
Vacuum cleaners	5	−3	6	− 2
Sewing machines	5	10	5	5
Gas stoves	2	2	1	1
Mechanical refrigerators	13	20	30	25
Jewelry	22	12	6	6
Clothing	125	125		
Property improvements	53	53	25	.
Tractors	8	34	25	9
Other farm machinery	2			
All other	54	54	25	25
Total	517	606	512	−540

volume of installment sales in 1925 and the percentage increase in outstandings in 1925 over 1923.

Another set of figures, which do not fit into Table 31 but which are to be noted, are those on the installment sales by department stores. For a group of New England department stores, the monthly average installment sales have been recorded since 1925 by the Boston Federal Reserve Bank. The monthly average installment sales in 1925 amounted to 5.2 per cent of the total sales, to 6.2 per cent in 1926, and to 6.7 per cent in 1927. Inasmuch as department stores sell furniture, pianos, phonographs, radio sets, washing machines, vacuum cleaners, sewing machines, jewelry, clothing, and electrical refrigerators, they have sometimes felt directly the competition in most items in which installment selling is extensively used, except in the case of automobiles, farm machinery, and various types of equipment such as heating apparatus.

Department stores included in the New England figures are chiefly the larger metropolitan stores, and their percentage of installment sales is higher than the percentage of installment sales made by department stores located in smaller cities. The Harvard Bureau of Business Research reported that in 1925 in those department stores, with sales of less than $1,000,000 each, which sold on installments, installment sales amounted to 2 per cent;[9] in 1926 to 3 per cent;[10] in those department stores with sales over $1,000,000 each which reported any installment sales, the installment sales amounted to 5 per cent of the total sales in 1925 and also in 1926 and 1927.[11] In 1927, about one-third of the stores reporting sold on installments.

These department store figures tend to corroborate the conclusions that can be drawn from the estimates of the increase in the volume of retail installment sales from 1923 to 1927. In stating these conclusions, however, it may be well to point out again that the estimates for changes in the volume of the retail installment sales are only rough guesses with no pretense at statistical accuracy. For reasons which have been indicated, it is safe to state that these estimates err on the side of liberality. In other words, these estimates, it is believed, represent a maximum figure for the increase in installment sales, and very likely the actual changes were substantially less.

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[9] Harvard University, Bureau of Business Research, Bulletin No. 57, *Operating Expenses in Department Stores in 1925*, p. 78.

[10] Harvard University, Bureau of Business Research, Bulletin No. 63, *Operating Expenses of Department Stores and Departmentized Specialty Stores in 1926*, p. 3.

[11] Harvard University, Bureau of Business Research, Bulletin No. 57, *Operating Expenses in Department Stores in 1925*, p. 23; Bulletin No. 63, *Operating Expenses of Department Stores and Departmentized Specialty Stores in 1926*, p. 6; Bulletin No. 74, *Operating Expenses of Department Stores and Departmentized Specialty Stores in 1927*, p. 9.

This establishment of a rough approximation of the maximum changes in the volume of retail installment sales is significant, because for 1923 Nystrom estimated the total volume of retail trade to be about $35,000,000,000.[12] For 1926 he estimated the total to be $40,000,000,000 and in 1927 again $40,000,000,000.[13] If the total increase in installment sales in 1925 as compared with 1923 was not appreciably over $600,000,000 out of a total volume of retail sales of perhaps $37,000,000,000, the factor of installment selling cannot be looked upon as one of the major influences affecting general business prosperity. If in 1926 there was a further increase of approximately $500,000,000 and in 1927 a decrease of perhaps $500,000,000 in installment sales out of total retail sales of $40,000,000,000 a year, it is necessary to look elsewhere for the chief explanation of changes in general business conditions. It must be remembered, furthermore, that in these figures one of the largest items for 1925 was the 10-payment sales of clothing, which, as has been stated, hardly deserves a place in these installment figures, since such sales were in considerable measure substitutes for book credit of equal length. Against the increase in installment credit, furthermore, some offsetting allowance of indefinite amount should be made for the decline in the credit purchases of such merchandise as groceries as a result of the spread of cash-and-carry chain stores.

On the basis of Ayres' original statement of the volume of installment sales and Nystrom's estimates of the total volume of retail business and the estimates of the changes in the volume of installment sales, it appears that the total volume of retail installment sales was 15.4 per cent of all retail sales in 1925, 15 per cent in 1926, and less than 15 per cent in 1927. If Seligman's estimates of the total volume of retail installment sales were used, then the installment sales amounted to only slightly more than 13 per cent of the total retail sales in 1925 and a smaller percentage of the total in 1926 and 1927, and if Nystrom's estimate of total retail sales was low, the ratio of installment sales to total sales would have been even less.

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[12] Paul H. Nystrom, "An Estimate of the Volume of Retail Business in the United States," *Harvard Business Review*, January, 1925, p. 150.

[13] Paul H. Nystrom, "Survey Shows Trends by Sales of Retail Trades," *Journal of Commerce*, New York, January, 28, 1928. Nystrom's estimate of $40,000,000,000 for the total volume of retail trade in 1926 appears to be conservative. The total sales of retail establishments, exclusive of restaurants, in the 11 cities in which the Census of Distribution was taken in 1926 amounted to $3,954,921,800. The population of those cities was slightly less than 6 per cent of the total population of the United States. The volume of retail trade in these cities probably was a greater percentage of the total retail trade of the United States than the population ratio would indicate, for such cities attracted some trade from outside their borders. It is not probable, however, that with 6 per cent of the population of the United States in those cities their volume of trade exceeded 10 per cent of the total. If 10 per cent were the correct ratio, the total volume of retail business of the country would have been $39,500,000,000, or approximately Nystrom's figure. That can be taken as a minimum estimate. It is probable, however, that the volume of retail business in these cities did not exceed 8.5 per cent of the total retail trade of the country, a ratio which would give an estimate of $46,000,000,000 for the total volume.

So far as individual industries are concerned, installment selling has been a factor of consequence in the development of those to which its use is particularly suited. Installment payments have long predominated in the sales of pianos and sewing machines. For many years, substantial quantities of furniture and jewelry have been sold on installments and in the farm machinery business installment sales long have been substantial in volume. Automobiles, radio sets, washing machines, vacuum cleaners, and mechanical refrigerators fall into the same general class as other merchandise which customarily has been sold on installments, and therefore it was but natural that the volume of installment sales should have increased in these industries as the total sales increased. The availability of credit for installment sales undoubtedly helped to lessen the sales resistance for radio sets, electrical refrigerators, and various other items coming upon the market during the period covered by this survey. The use of installment credit, however, was a means of lessening sales resistance rather than a positive stimulus to sales. Hence the primary cause for the changes in the volume of business in these trades must be sought elsewhere rather than in installment selling, and, as a matter of fact, it is probable that the amounts spent for advertising and sales promotion annually in the United States have had a greater influence than installment sales on the developments during the last ten years.

In reaching these conclusions regarding installment selling, it is fitting to offer a brief suggestion as a possible explanation of the importance that has been attached, in popular discussions, to installment selling as a factor in business prosperity since 1924.

Installment selling had been used for many years, as has been stated, in the sales of sewing machines, pianos, furniture, books, and agricultural implements. The International Harvester Co., upon its organization, undertook to provide credit for sales of farm machinery which previously had been provided by the retailers from their own resources or from local banks. This facilitated the granting of credit and the establishing of greater uniformity of practice. When the automobile business developed, it paralleled the farm machinery business in this respect as in numerous others. In 1912, the first finance company was organized, it is stated, for dealing in automobile notes, and from that date the financing of automobile sales through the discounting of notes with finance companies increased. Originally, the automobile dealers had obtained the bulk of their credit for installment sales from banks, and a substantial amount of business is still financed in that way.

With the rapid increase in the number of finance companies, a factor was injected into the situation which helps to explain the attention which has been directed toward installment selling since 1923. At that time, it appears from evidence which has been cited, the volume of installment sales of automobiles probably was tending to slacken, or, at all events, the finance companies could not readily secure so large a volume of notes to purchase as they desired. Hence the terms with respect to down payments and length of the installment period were relaxed in the automobile business in 1924, and the finance companies, casting around for business, sought to induce various manufacturers of other products to utilize the installment method. Public attention thus was attracted in such a manner as to give an exaggerated impression of the new development.

VII. ADVERTISING[14]

By stimulating demand, advertising has served as a stabilizing influence for some industries and as a means of securing economy in selling in other industries. It has exerted a strong influence on changes in demand, and in some instances has tended to cause speculative buying to be supplanted by more orderly merchandising.

No complete figures are available on the amount spent annually for advertising in the United States. In the absence of better data, the following rough estimate has been made of advertising expenditures for all purposes in 1927, by classes of mediums: newspapers, $690,000,000; magazines, $210,000,000; direct advertising, $400,000,000; street car cards, $20,000,000; outdoor advertising, $75,000,000; radio, $7,000,000; business papers, $75,000,000; premium advertising, programs, and directories, $25,000,000; total, $1,502,000,000. For some items in this estimate the figures are demonstrably close to the truth; for others the amount of error not only is uncertain but may be large. Nevertheless, even after allowing for the maximum probable error, this estimate, like various other rough estimates in this survey, is believed to be useful in furnishing some concept of the magnitude of the economic factors with which we are dealing. The changes in the volume of advertising in the various classes of mediums are, so far as possible, indicated below.

Newspaper.—Since 1921, not to go back into earlier years, a decline has occurred in the number of newspapers published in English in the United States. In 1921 there were 427 morning papers, 1,601 evening papers, and 545 Sunday papers. In 1927 the numbers were: morning, 411; evening 1,538; Sunday, 526. Hence such changes as have taken place in the volume of newspaper advertising have not resulted from an increase in the number of publications in this class of mediums. The chief factors, therefore, in judging changes in the volume of newspaper advertising for this period are the lineage of advertisements published, circulation, and rates.

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[14] The statistical material for this section was collected under the supervision of Prof. Neil H. Borden, of the Harvard Graduate School of Business Administration.

Table 32 shows the average net paid circulation of all daily newspapers, including both morning and evening papers, and of Sunday newspapers in the United States, for the period 1921 to 1927.

TABLE 32.—CIRCULATION OF NEWSPAPERS IN THE UNITED STATES[a]

Year	Daily newspapers		Sunday newspapers	
	Total net paid circulation	Relative (1921 = 100)	Total net paid circulation	Relative (1921 = 100)
1921	28,423,740	100	19,041,413	100
1922	29,780,328	105	19,712,874	103
1923	31,453,683	111	21,463,289	112
1924	32,999,427	116	22,219,646	116
1925	33,739,369	119	23,354,622	122
1926	36,001,803	127	24,435,192	128
1927	37,966,656	134	25,469,037	133

[a] Compiled from annual editions of *Editor and Publisher*, International Yearbook Numbers

Despite the slight decline that took place in the total number of newspapers, the average circulation of both the daily newspapers and the Sunday newspapers increased continually from 1921 to 1927, with more rapid increase in 1923, 1926, and 1927 than in the other years. The average circulation of the daily papers was 34 per cent greater and of the Sunday papers 33 per cent greater in 1927 than in 1921.

The quantity of advertising published, irrespective of the number of copies of the papers sold, is best measured by agate lines. Data on the advertising lineage in all newspapers are not available, but the *New York Evening Post* has compiled lineage figures, shown in Table 33, for the advertising in the newspapers in 29 selected cities since 1921. The circulation of the papers in this list comprised slightly over one-half the total daily newspaper circulation in the United States in 1927.

TABLE 33.—TOTAL ADVERTISING LINEAGE IN NEWSPAPERS IN 29 SELECTED CITIES[a]

Year	Agate lines	Relative (1921 = 100)
1921	1,177,284,988	100
1922	1,240,403,281	105
1923	1,351,754,117	115
1924	1,379,445,141	117
1925	1,440,077,004	122
1926	1,503,034,867	128
1927	1,442,784,907	123

[a] *New York Evening Post*, Statistical Department, "Total Newspaper Advertising of the Principal Cities of the United States," published monthly, data compiled from annual summaries.

The number of agate lines of advertising in daily newspapers increased continually from 1921 to 1926, with an especially heavy increase in 1923. Although the number of lines of advertising fell off in 1927, it is worth noting, nevertheless, that even in 1927 the lineage was 23 per cent greater than in 1921, while the total circulation, as has been pointed out, was 34 per cent greater.

As an index to newspaper advertising rates, the *Editor and Publisher* has compiled (Table 34) the joint minimum advertising line rate for all daily newspapers and Sunday newspapers. The joint rate indicates the cost of one line for one insertion in all newspapers in the United States.

TABLE 34.—ADVERTISING RATES[a]

Year	Morning and evening newspapers		Sunday newspapers	
	Joint minimum agate line rate	Relative (1921 = 100)	Joint minimum agate line rate	Relative (1921 = 100)
1921	$ 86.051	100	$44 253	100
1922	90.645	105	45 820	103
1923	97.318	113	48 672	109
1924	102.077	118	51.098	115
1925	105 568	122	54 243	122
1926	110 251	128	56 956	128
1927	114 209	132	58 478	132

[a] *Editor and Publisher*, International Yearbook Numbers, annual editions.

The advertiser is interested, of course, in both circulation and rates. A combined index of those two factors is obtained by computing the milline rate, that is the rate per line per million circulation.

TABLE 35.—MILLINE RATES FOR NEWSPAPER ADVERTISING

Year	Morning and evening newspapers		Sunday newspapers	
	Milline rate	Relative	Milline rate	Relative
1921	$3 03	100	$2 32	100
1922	3 04	100	2 33	100
1923	3.09	102	2 27	98
1924	3.10	102	2 29	98
1925	3 13	103	2.32	100
1926	3 06	101	2 33	100
1927	3.01	99	2 29	98

The above figures for milline rates indicate that, for the United States as a whole, the increases in newspaper advertising rates from 1921 to 1927 corresponded closely to the changes in circulation. In the larger cities, however, the rates did not advance so rapidly as circulation increased. The relative for the milline rate of the newspapers in the 29 cities on the *New York Evening Post* list was as follows: 1921, 100; 1922, 101; 1923, 98; 1924, 93; 1925, 93; 1926, 89; 1927, 88.

The census of manufactures reported[15] that newspapers in the United States received $521,685,483 for advertising in 1921, $580,937,741 in 1923, and $661,513,242 in 1925. These figures indicated that newspaper receipts for advertising were 11 per cent greater in 1923, and 26 per cent greater in 1925, than in 1921. These figures, however, did not show an increase proportional to the increase in lineage and the advance in agate line rates recorded above. The discrepancy probably arose from the practice of some newspaper publishers of granting reduced rates on contracts with large local advertisers and from the inelasticity of rates on classified advertising, such as "want ads." From 1925 to 1927, the increase in newspaper advertising expenditures is judged not to have been large.

The Bureau of Advertising of the American Newspaper Publishers' Association has estimated the total expenditures for newspaper advertising in the United States to have been $690,000,000 in 1927. This figure is not directly comparable with the census figures quoted above, since the advertisers' payments covered commissions to advertising agents and special newspaper representatives which were not included in the net receipts of the newspapers. In the light of the census figures and of the analyses of circulation, lineage, and rates that have been made, however, the estimate of $690,000,000 for the total volume of expenditures for newspaper advertising in 1927 can be accepted as approximately correct. This total comprised expenditures of $210,000,000 for national advertising and $480,000,000 for local advertising.

Magazine.—For magazine advertising, more dependable figures are available than for advertising in any other class of mediums. The attainment of this greater degree of accuracy has been facilitated by the relatively small number of publications, the standardization of rates, and the pioneer enterprise of such institutions as *Printers' Ink* and the Curtis Publishing Co. in publishing records. For 1927, the Curtis Publishing Co., on the basis of computations of the Advertising Record Co., gave the expenditures for advertising in 65 magazines as $177,215,898. The Denney Publishing Co., in its *National Advertising Records* (published only since 1925), computed the advertising expenditures in 90 magazines in 1927 as $190,817,540; that list was stated to have included all magazines of advertising importance. To allow for advertising expenditures in minor magazines, however, I have placed the estimate of magazine advertising at $210,000,000. That figure contains only a small percentage of error.

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[15] *United States Biennial Census of Manufactures*, 1925, p. 659.

TABLE 36.—TOTAL CIRCULATION[a] OF SELECTED MAGAZINES

(*Printers' Ink* list and selected list of agricultural magazines)

Year	General		Weekly		Women's		Class		Total (four classes)		Agricultural	
	Circulation	Relative 1921 = 100	Circulation	Relative 1921 = 100	Circulation	Relative 1921 = 100	Circulation	Relative 1921 = 100	Circulation	Relative 1921 = 100	Circulation	Relative 1921 = 100
1921	6,718,587	100	7,560,438	100	12,665,052	100	1,809,618	100	28,753,695	100	5,752,441	100
1922	6,832,525	102	8,853,387	117	13,369,881	105	1,838,211	101	30,894,004	107	6,019,901	105
1923	7,428,984	110	9,700,026	128	14,541,673	115	1,965,959	109	33,636,642	117	6,076,140	106
1924	7,975,027	119	9,289,427	123	15,615,590	123	2,122,460	117	35,002,504	122	6,232,589	108
1925	7,815,901	116	9,607,429	127	15,934,546	126	2,153,894	119	35,511,770	123	5,915,664	103
1926	7,897,098	117	10,247,751	136	16,887,646	133	2,222,610	123	37,255,105	130	6,761,459	118
1927	7,848,663	117	11,122,917	147	17,023,265	134	2,374,596	131	38,369,441	133	7,174,989	125

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[a] Compiled from records in reports of *Standard Rate and Data Service.*

In order to show the changes in the amount of magazine advertising since 1921, statistics regarding circulation, rates, lineage, and an index to the total volume of magazine advertising are summarized. In this summary, use is made of two lists of magazines—one, the *Printers' Ink* list, including 61 magazines; and the other, the Curtis Publishing Co. list, including 65 magazines. The lists are so similar, and each comprises such a large part of the magazine advertising pages, that no appreciable allowance has to be made in changing from one series to the other. Changes have occurred unavoidably in the make-up of these lists over a period of years, but those changes have not distorted the series. The total circulation per issue of magazines in the *Printers' Ink* list, subdivided into four groups, and of a selected list of agricultural magazines was as stated in Table 36. These circulation figures were compiled from the reports on the circulation of the individual magazines published by the *Standard Rate and Data Service.*

While the circulation of the weekly magazines increased most rapidly and of the general magazines least rapidly, it is noteworthy that the circulation for the entire group increased at approximately the same rate that newspaper circulation[16] increased.

In 1927, the average agate line rate for general magazines in the selected list was $2.99, for weekly magazines $5.19, for women's magazines $7.33, for class magazines $1.50, and for agricultural magazines $4.81. Table 37 shows the relative changes in the average agate line rate from 1921 to 1927.

TABLE 37.—AVERAGE AGATE LINE RATE FOR SELECTED MAGAZINES[a]
(*Printers' Ink* list and selected list of agricultural magazine; relative, 1921 = 100)

Year	General	Weekly	Women's	Class	Total (four groups)	Agricultural
1921	100	100	100	100	100	100
1922	97	100	100	103	99	97
1923	101	108	111	110	107	100
1924	106	110	115	115	111	102
1925	111	120	118	117	117	111
1926	115	124	120	123	120	118
1927	115	128	118	132	122	122

[a] Computed from data published by *Standard Rate and Data Service.*

When the relatives in Table 37 are compared with those in Table 36, it appears that agate line rates increased somewhat less rapidly than the circulation, particularly in the case of the weekly magazines and women's magazines.

The fact that magazine circulation increased more rapidly than rates is shown clearly in Table 38, which gives the relatives for the joint milline

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[16] See Table 32.

TABLE 39.—LINEAGE OF ADVERTISING IN SELECTED MAGAZINES[a]

(*Printers' Ink* list)

Year	General		Weekly		Women's		Class		Total	
	Lines (000 omitted)	Relative (1921 = 100)	Lines (000 omitted)	Relative (1921 = 100)	Lines (000 omitted)	Relative (1921 = 100)	Lines (000 omitted)	Relative (1921 = 100)	Lines (000 omitted)	Relative (1921 = 100)
1921	4,215	100	4,698	100	4,876	100	4,171	100	17,959	100
1922	4,441	105	4,794	102	5,271	108	5,173	124	19,679	110
1923	4,854	115	6,092	130	6,326	130	6,190	148	23,462	131
1924	4,754	113	6,435	137	6,471	133	6,558	157	24,217	135
1925	4,757	113	7,010	149	6,772	139	6,946	167	25,485	142
1926	4,877	116	7,215	154	7,193	147	7,959	191	27,244	152
1927	4,940	117	7,101	151	7,113	146	8,406	202	27,560	153

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[a] Compiled from statistics published periodically in *Printers' Ink*.

rate of magazines in the *Printers' Ink* list and the selected list of agricultural magazines.

TABLE 38.—JOINT MILLINE RATE OF SELECTED MAGAZINES[a]
(*Printers' Ink* list and selected list of agricultural magazines)
(Relative, 1921 = 100)

Year	General	Weekly	Women's	Class	Total (four groups)	Agricultural
1921	100	100	100	100	100	100
1922	95	86	95	101	92	93
1923	91	84	96	102	92	95
1924	89	90	93	98	92	94
1925	87	84	94	98	90	96
1926	89	81	90	100	88	89
1927	90	77	88	95	86	87

[a] Compiled from data published by *Standard Rate and Data Service*

Table 39 shows the increase in the lineage of advertising published in the magazines in the *Printers' Ink* list from 1921 to 1927.

From these figures it appears that the quantity of magazine advertising, measured in lines, increased over 50 per cent from 1921 to 1927, and approximately 40 per cent from 1922 to 1927. Inasmuch as rates were increasing, however, and more color was being used from year to year in the advertising copy, the total expenditures for advertising increased more rapidly than the lineage. Table 40 shows the figures for the annual advertising expenditures in all the magazines in the Curtis Publishing Co.'s list.[17]

TABLE 40.—EXPENDITURES FOR ADVERTISING IN MAGAZINES[a]

Year	Total	Relative (1921 = 100)
1921	$ 95,665,384	100
1922	98,718,210	103
1923	121,296,448	127
1924	134,346,768	140
1925	148,600,572	155
1926	164,881,704	172
1927	176,277,984	184

[a] Curtis Publishing Company, *Leading Advertisers*, annual editions.

While this list did not include all magazines, it was, as has been stated, a large sample, and the figures can be relied upon as showing the relative increase in advertising expenditures. It is to be noted that a sharp increase took place in 1923 and that the expenditures continued to increase until in 1927 they were 84 per cent greater than in 1921. These increases in advertising expenditures, together with more intelligent utilization of those expenditures, probably constituted one of the main reasons for the high degree of activity maintained by many American businesses from 1923 to 1927.

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[17] A similar tabulation was made for the expenditures in the magazines in the *Printers' Ink* list and the relatives corresponded closely to those for the advertising in the Curtis Publishing Co.'s list of magazines.

Direct Advertising.—This includes all advertising booklets, circulars, and announcements distributed to consumers or users by mail or by other direct means, and is of a very uncertain aggregate volume. No means have been discovered of making an estimate that is more than a guess. Opinions regarding the total volume in 1927, expressed by various persons experienced in direct advertising, ranged from $300,000,000 to $550,000,000. These opinions thus indicate that very likely the total expenditure for direct advertising in the United States in 1927 was about $400,000,000. The amount expended for this type of advertising undoubtedly increased substantially between 1921 and 1927.

Outdoor Advertising.—In this class are included painted displays, posters, and electrical signs. The outdoor advertising companies which had authentic facts regarding expenditures for that type of advertising were not willing to furnish any definite figures. From estimates obtained from other sources it was concluded, however, that the total expenditures for outdoor advertising in the United States were approximately $75,000,000 in 1927. The amount by which these expenditures had increased between 1921 and 1927 is problematical. On the one hand, there was an increase in the expenditures for electrical signs and other outdoor advertising in urban districts. On the other hand, legislative action and public criticism led several companies, which had used billboards extensively, to remove their signs from highways.

Street Car Cards.—The expenditures for advertising by means of street car cards are more definitely ascertainable than the expenditures for direct advertising and for outdoor advertising, since street car advertising is in the hands of relatively few companies and the amount of available space as well as the rates are definitely known by those companies. Detailed figures were not forthcoming, but an estimate was secured which placed the total street car advertising at $20,000,000 in 1927.

Radio.—The utilization of radio broadcasting for advertising purposes has been one of the strongest influences causing the rapid expansion of the radio industry from 1922 to 1928. This advertising acquainted consumers with radio receiving apparatus, and the programs broadcast by other than radio manufacturers were of a character to stimulate a continually broadening desire for the ownership of radio sets. The organization of the National Broadcasting Co. in 1926, and subsequently of the Columbia Broadcasting System, facilitated broadcasting through chains of stations. Thus an expensive program could be broadcast to a large number of listeners and its advertising value enhanced. The rate card of the National Broadcasting Co , dated March 1, 1928, quoted a rate of $4,740 an hour for its "red network" of 20 stations for the hours between 7 and 11 P.M. For one-half hour, the rate was $2,962.50 and for one-quarter hour $1,845.37. Rates for other hours were one-half the evening rates. Discounts were granted on contracts covering more than 24 periods. The evening rates of the Columbia Broadcasting System of 17 stations in 1928 were $5,000 per hour, or $2,500 per half-hour, for the services of the stations and of performers; without performers, $4,000 and $2,000.

A list of the 79 companies and institutions which employed the facilities of the National Broadcasting Co. in 1927 was published,[18] together with a computation of the amounts paid for the broadcasting service. According to that computation, the total expenditures of those companies were $3,760,010 in 1927. In order to obtain an estimate of the total expenditures for radio advertising, it is necessary to add to the figure just stated an allowance for the amounts paid to artists and other performers and also an allowance for the amounts spent in advertising through local stations. Hence the total expenditures for radio advertising in the United States in 1927 were estimated to have been approximately $7,000,000.

Trade Journals.—Business papers, which constitute another large group of advertising mediums, include industrial magazines, such as *American Machinist, Iron Age, Railway Age,* and *Iron Trade Review;* trade publications, such as *Dry Goods Economist, Hardware Age,* and *Building Supply News;* and class publications, such as *Cafeteria Management* and *Purchasing Agent.* The total number of business papers in the United States in September, 1928, according to a tabulation of such papers listed by the *Standard Rate and Data Service,* was 1,782. That figure represented a net increase of somewhat more than 100 publications from 1921 to 1928. Since numerous publications in this class are not members of the Audit Bureau of Circulations, dependable figures are not available for the circulation of the entire group. No complete record has been compiled for the volume of advertising in the group. Sufficient figures have been assembled, nevertheless, for a portion of the group, to show the trend of circulation, rates, and volume of advertising from 1921 to 1927.

The list of magazines which has been utilized for the sample tests is that used by *Class and Industrial Advertising* in compiling monthly and yearly records of industrial advertising. This list has varied somewhat from year to year, but the methods of computation which have been used discount the effects of those variations on the statistics used. The list in 1928 comprised 48 industrial magazines, 18 trade publications, and 13 class publications.

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[18] *Advertising and Selling,* May 30, 1928, p. 72.

In order to show the trend of circulation (Table 41), the average circulation per magazine in the *Class and Industrial Advertising* list was computed and the relatives were determined on the basis of 1921 = 100.

TABLE 41.—AVERAGE CIRCULATION OF SELECTED BUSINESS PAPERS[a]

(*Class and Industrial Advertising* list; relative, 1921 = 100)

Year	Industrial	Trade	Class	Total
1921	100	100	100	100
1922	99	101	84	97
1923	108	101	84	108
1924	132	110	87	118
1925	127	110	90	116
1926	134	110	89	120
1927	137	113	92	123

[a] Computed from figures compiled from *Standard Rate and Data Service.*

The circulation of the industrial subgroup increased at about the same rate as that of newspapers and consumers' magazines, but the figures for the entire group were kept down by the lag in the circulation of the trade and class groups.

As a guide to the trend of advertising rates in business papers, the average page rate for a single insertion in black and white was computed for the list of magazines cited above.

TABLE 42.—AVERAGE PAGE RATE OF SELECTED BUSINESS PUBLICATIONS[a]

(*Class and Industrial Advertising* list; relative, 1921 = 100)

Year	Industrial	Trade	Class	Total
1921	100	100	100	100
1922	102	105	103	103
1923	106	105	107	106
1924	116	115	109	114
1925	119	118	115	118
1926	125	120	119	123
1927	133	130	121	130

[a] Computed from figures compiled from *Standard Rate and Data Service.*

A comparison of the relatives in Table 42 with those in Table 41 shows that advertising rates in the industrial subgroup nearly kept pace with the increase in circulation and that the advertising rates of the trade and class subgroups rose substantially faster than circulation increased.

The number of pages of advertising in the business publications on its list has been compiled by *Class and Industrial Advertising* since 1923, and the figures in Table 43 are taken from its charts.

TABLE 43.—VOLUME OF ADVERTISING IN SELECTED BUSINESS PAPERS[a]

(*Class and Industrial Marketing* list)

Year	Industrial	Trade	Class	Total
	Pages	*Pages*	*Pages*	*Pages*
1923	119,600	43,100	12,100	174,800
1924	125,700	40,800	14,400	180,900
1925	117,500	40,700	13,500	171,700
1926	118,700	39,800	14,870	173,370
1927	111,500	39,600	15,250	166,350

[a] From charts published in *Class and Industrial Marketing*, January, 1928

Data on the volume of advertising published were obtained privately from the publishers of 25 leading industrial papers. That series (Table 44) resembles, but does not agree entirely with, the fluctuations in the series in Table 41.

TABLE 44.—VOLUME OF ADVERTISING IN 25 INDUSTRIAL PAPERS

Year	Pages	Relative (1921 = 100)
1921	99,483	100
1922	85,372	86
1923	89,850	90
1924	90,448	91
1925	88,987	89
1926	92,024	92
1927	91,693	92

Since rates were about 30 per cent higher, and the number of pages of advertising about 8 per cent less, in 1927 than in 1921, total advertising expenditures in business papers apparently increased about 20 per cent during the period. From 1923 to 1927 the total expenditures are estimated to have increased 24 per cent.

The number of pages of advertising multiplied by the page rate indicates that the expenditures for advertising in the magazines in the *Class and Industrial Advertising* list in 1927 were approximately $28,000,000. This list included many of the largest and most progressive business publications. Hence it is concluded that an estimate of $75,000,000 for the advertising expenditures in all business papers in 1927 is fair.

Other Mediums.—To cover advertising expenditures for premiums, programs, and directories, an estimate of $25,000,000 has been made.

The series which are available for various classes of mediums show that the total advertising expenditures in the United States increased substantially in 1923 and that further increases took place in subsequent years. From 1921 to 1927, the increase approximated 50 per cent.

In connection with advertising expenditures, reference should be made also to the expenditures for other types of sales promotion, such as the employment of missionary salesmen, who solicited orders from retailers or users to be filled by wholesalers or dealers, the distributors receiving their full margin on orders turned over to them to be filled. Missionary salesmen had been employed extensively, of course, prior to 1921, but a marked increase took place after that date. In 1928 it was stated, on good authority, that about $60,000,000 a year was spent by grocery manufacturers for missionary salesmen. Missionary salesmen also were employed extensively by drug manufacturers and by numerous manufacturers in other industries selling both consumers' goods and industrial goods. In 1927, the annual expenditures for this type of sales promotion in the United States probably amounted to something like $150,000,000, but the expenditures were beginning to decline, because of increasing doubts among manufacturers as to whether such missionary work was sufficiently effective to offset its cost under any but special conditions.[19]

Volume of Advertising.—The volume of advertising naturally has varied greatly between industries, because of the diversity of conditions affecting production and marketing and because of varying degrees of alertness in management. For 1926 and 1927, figures have been compiled on the amount of national advertising in daily newspapers of 49 cities for various groups of products and services. The figures for 1927, which were similar to those for 1926, are shown in the following table.

Table 45.—National Newspaper Advertising, by Commodity Groups, in 1927[a]

	Per cent of total
Automobiles	19.3
Automobile accessories, parts, and supplies	5.7
Cigars, cigarettes, and tobacco	10.2
Financial	3.2
Food, groceries, and beverages	13.1
Hotels and resorts	1.7
Household furniture	2.0
Men's clothing	1.1
Musical instruments	0.6
Radio and electrical	5.4
Railroads and steamships	6.4
Shoes	0.6
Toilet articles and medicinal preparations	17.9
Women's wear	0.5
Miscellaneous	12.3
Total	100.0

[a] Computed from lineage figures published by *Printers' Ink* and summarized in the *Survey of Current Business*.

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[19] See *Harvard Business Reports*, Vol. V, pp. 460–466, 470–472, 511–526.

The advertisements of automobiles; toilet articles and medicinal preparations; food, groceries, and beverages; and cigars, cigarettes, and tobacco, thus constituted 60.5 per cent of the total national advertising in newspapers in these cities in 1927. For local commodity advertising in newspapers, in contrast to manufacturers' advertising in those mediums, the percentages would be quite different, with the advertising of women's and men's wearing apparel bulking large.

No data, which would constitute a representative sample, are available to show what changes have taken place over a period of years in the volume of newspaper advertising by classes of commodities. For magazine advertising, however, it is possible to indicate such changes with a high degree of accuracy. For a series of years the Curtis Publishing Co. has published compilations of the amounts spent by advertisers who paid more than $20,000 each for advertising in any or all of 32 magazines.[20] This list of magazines comprised such a large percentage of the total volume of magazine advertising that it furnishes a dependable index to magazine advertising. The statistics in Table 46 were compiled from that source and show how the expenditures for magazine advertising were divided among major groups of commodities in 1922 and 1927.

TABLE 46.—MAGAZINE ADVERTISING IN 1922 AND 1927; PERCENTAGE OF EXPENDITURES FOR EACH COMMODITY GROUP[a]

(100 per cent = total expenditures of advertisers spending $20,000 or more in 32 magazines)

Commodity group	1922	1927
	Per cent	*Per cent*
Automotive	7.04	8.88
Automotive accessories, parts, and supplies	7.11	8.49
Beverages	1.22	1.36
Candy and gum	0.88	1.40
Electrical and radio	2.06	3.84
Food	13.30	15.33
Heating	2.73	1.81
Household	7.90	8.70
Jewelry and silverware	2.54	2.37
Lubricants and fuel oils	1.68	2.08
Musical instruments	2.46	1.35
Office equipment and supplies	2.80	1.96
Paints and varnishes	1.95	2.27
Shoes	2.30	1.87
Smoking materials	1.04	1.14
Soaps and cleansers	7.00	4.93
Textiles	1.31	1.14
Toilet goods	8.80	9.90
Men's wearing apparel	1.82	0.96
Women's wearing apparel	4.13	1.93
Other goods and services	19.83	18.29

[a] Computed from data in Curtis Publishing Co., *Leading Advertisers*, annual editions.

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[20] Curtis Publishing Co., *Leading Advertisers*, annual editions. Prior to 1925, the compilation included all advertisers spending in excess of $10,000 each in the selected magazines. This change in the limit had little practical significance

The groups of commodities advertised most extensively in 1927 included foods, toilet goods, household goods, automobiles and trucks, and automotive accessories, parts, and supplies. Those five groups together accounted for 51.3 per cent of the magazine advertising in 1927. They showed a more rapid increase in magazine advertising, furthermore, than was shown by numerous other commodities, for in 1922 they accounted for only 44.15 per cent of the total expenditures for advertising in magazines.

Advertising Expenditures for Particular Commodities.—In the following tables, statistics are given for the annual expenditures for magazine advertising of particular commodities.[21] The rapid growth of the radio business and of the electrical refrigerator business, for example, has been stimulated by heavy expenditures for advertising. In seven years, radio advertising in selected magazines rose from nothing to $3,428,159 and electrical refrigerator advertising to $1,517,836, as shown by Table 47.

TABLE 47.—MAGAZINE ADVERTISING OF RADIO AND ELECTRICAL REFRIGERATORS

Year	Radio and radio equipment	Electrical refrigerators
1922	$79,869	.....
1923	587,715	$44,642
1924	1,983,926	114,249
1925	3,822,850	415,348
1926	3,430,629	1,120,033
1927	3,428,159	1,517,836

A wide difference of opinion exists regarding the quality of much of the current automotive advertising. Nevertheless, the industry is one of the heaviest users of magazine space as well as of newspaper space and of other types of mediums. Automotive advertising in magazines

TABLE 48.—AUTOMOTIVE ADVERTISING IN MAGAZINES

Year	Passenger cars	Trucks	Tires	Accessories, parts, and supplies
1921	$3,479,561	$577,773	$2,011,170	$3,501,578
1922	4,780,606	526,851	2,433,821	4,162,393
1923	7,731,223	642,787	2,612,027	6,207,125
1924	8,875,927	748,313	2,015,088	7,310,920
1925	9,389,919	908,749	3,229,414	7,708,606
1926	11,427,386	807,149	3,585,006	8,828,422
1927	11,937,328	930,350	3,555,012	9,269,600

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[21] The data in all the following tables were compiled from Curtis Publishing Co., *Leading Advertisers*, annual editions.

has increased, as shown in Table 48, since 1921, the expansion in the advertising of passenger cars and of accessories, parts, and supplies in 1923 being particularly noteworthy.

The magazine advertising of certain types of foods and related products has shown expansion (Table 49). This advertising by manufacturers probably facilitated the growth of chain stores, whose methods of merchandising are best applied to branded merchandise sold in packages.

TABLE 49.—MAGAZINE ADVERTISING OF CERTAIN FOODS AND RELATED PRODUCTS

Year	Canned goods	Cereals, flour, bread, and crackers	Desserts, flavorings, jams, salad dressings, etc	Tea, coffee, and substitutes	Candy and gum
1921	$3,417,042	$2,507,883	$1,194,463	$386,796	$609,655
1922	4,141,565	2,153,222	1,050,205	371,158	689,585
1923	4,358,527	2,852,992	1,284,037	621,921	734,041
1924	5,647,883	3,630,692	1,569,631	849,110	721,468
1925	6,133,525	4,052,244	1,804,416	1,156,071	1,142,814
1926	6,595,024	5,169,724	2,075,639	1,305,245	1,470,983
1927	8,080,837	5,467,969	2,515,964	1,268,757	2,154,540

Textile fabrics, in the sale of which pattern and design play such an important part, are difficult to advertise effectively. This fact probably affords a partial explanation of the relatively small expenditures for the advertising of such goods. Table 50 shows the annual expenditures for the advertising of textile fabrics, hosiery, and underwear in magazines.

TABLE 50.—MAGAZINE ADVERTISING OF TEXTILE FABRICS, HOSIERY, AND UNDERWEAR

Year	Textile fabrics	Hosiery	Underwear
1921	$978,099	$907,460	$954,137
1922	1,027,306	1,135,212	859,617
1923	1,145,471	1,443,485	1,181,562
1924	1,213,643	1,524,038	964,114
1925	1,364,348	1,738,061	790,481
1926	1,185,892	1,613,552	773,024
1927	1,758,849	1,622,123	647,611

Table 51 gives similar statistics for the advertising of ready-to-wear clothing and shoes in magazines. These figures, when compared with those for numerous other commodities, suggest that one reason for the lack of prosperity in the textile industry may have been the failure of garment manufacturers to stimulate a sufficiently effective demand for their products.

TABLE 51.—MAGAZINE ADVERTISING OF READY-TO-WEAR CLOTHING AND SHOES

Year	Women's ready-to-wear	Men's ready-to-wear	Men's furnishings	Shoes
1921	$1,330,083	$994,179	$351,112	$1,719,585
1922	1,244,280	978,428	452,247	1,808,662
1923	1,184,210	902,135	482,760	2,399,201
1924	1,150,643	908,835	559,359	2,556,403
1925	1,199,714	895,718	650,253	2,331,156
1926	787,323	818,195	644,428	2,680,958
1927	698,448	773,348	695,796	2,721,280

The magazine advertising of various types of home equipment has increased notably during recent years (Table 52).

TABLE 52.—MAGAZINE ADVERTISING OF SELECTED ITEMS OF HOME EQUIPMENT

Year	Furnaces and heating systems	Bathroom equipment and plumbing fixtures	Furniture	Rugs and other floor coverings	Electric vacuum cleaners, sweepers, and floor polishers
1921	$888,196	$386,837	$546,288	$1,376,044	$593,294
1922	823,932	363,900	566,564	1,484,680	658,559
1923	741,008	492,347	1,093,183	2,206,590	981,716
1924	1,135,135	774,117	1,227,806	2,994,274	1,084,251
1925	1,101,141	1,179,502	1,181,610	3,988,369	1,005,515
1926	1,253,682	999,895	1,032,018	3,383,219	1,706,165
1927	1,196,851	1,113,461	1,178,293	2,998,890	1,483,964

The three classes of commodities for which magazine advertising expenditures are given in Table 53 have nothing in common; they are brought together merely for convenience in tabulation. The relatively small expenditures for hardware and cutlery advertising and the heavy expenditures for soap advertising are noteworthy.

TABLE 53.—MAGAZINE ADVERTISING OF HARDWARE AND CUTLERY; PAINTS AND VARNISHES; SOAPS AND CLEANERS

Year	Hardware and cutlery	Paints and varnishes	Soaps and cleansers
1921	$544,676	$1,366,982	$4,903,968
1922	374,600	1,559,748	5,499,130
1923	632,102	2,229,007	6,273,478
1924	938,138	2,474,116	6,288,130
1925	939,400	3,254,150	7,038,277
1926	712,055	3,317,200	7,206,104
1927	727,647	3,336,421	7,363,311

Table 54 shows the changes in the expenditures for magazine advertising of silverware, jewelry, timepieces, pens and pencils, and musical instruments.

TABLE 54.—MAGAZINE ADVERTISING OF SILVERWARE, JEWELRY, TIMEPIECES, PENS AND PENCILS, AND MUSICAL INSTRUMENTS

Year	Silverware	Jewelry	Clocks and watches	Pens and pencils	Phonographs and records	Pianos, organs, and piano rolls
1921	$784,176	$409,429	$959,312	$676,719	$2,324,640	$259,906
1922	712,855	385,371	898,937	568,958	1,355,542	443,423
1923	1,046,203	481,810	884,036	579,798	1,450,635	689,635
1924	1,195,324	336,778	1,023,475	871,667	1,417,877	505,673
1925	1,297,346	307,975	1,156,068	1,108,412	1,168,299	442,379
1926	1,299,725	459,187	1,325,109	1,253,191	1,028,570	570,765
1927	1,427,058	505,339	1,569,089	1,246,611	1,360,194	585,112

The expenditures for the magazine advertising of toilet goods (Table 55) constituted a substantial percentage of all magazine advertising in 1921 and an even higher percentage in 1927. Although criticism has been directed at certain types of advertising employed by some manufacturers of articles in this category, the expenditures for magazine advertising have mounted rapidly.

TABLE 55.—MAGAZINE ADVERTISING OF TOILET GOODS

Year	Dentifrices	Face creams and lotions	Face powder	Shaving soap	Other toilet goods
1921	$1,443,038	$483,253	$380,749	$423,777	$3,535,610
1922	1,516,567	750,216	409,343	411,548	3,832,756
1923	1,623,425	1,020,058	288,522	563,881	4,780,601
1924	1,933,460	1,054,172	514,398	660,974	5,498,997
1925	2,475,620	1,263,757	617,494	712,457	5,664,411
1926	3,453,114	1,990,813	806,189	715,013	6,546,106
1927	3,389,272	2,057,573	673,722	819,585	7,978,383

These detailed figures for changes in the expenditures for magazine advertising by the producers of various commodities provide significant facts for the analysis of causes of the degree of prosperity and rate of growth of numerous industries. They also show that powerful influences have been at work to cause changes in demand.

Improvement in Quality.—In addition to the quantitative changes in the volume of advertising, which have been analyzed in the preceding pages, the quality of advertisements has tended to show real improvement during this period. This qualitative improvement was facilitated by the broader utilization of certain technical processes, such as offset printing, rotogravure, the aquatone process, and the Smithsonian process for the application of four color plates on noncoated paper. A notable improvement has occurred also during this period in the art work, both in consumer advertising and in industrial advertising. The improvement in art work has not been uniform, of course, for all advertisers, but examples of it can be found in magazine advertising, industrial advertising, newspaper advertising, and direct mail circulars.

Some magazine and newspaper publishers adopted a policy, about twenty years ago, of excluding unreliable and undesirable types of advertising from their pages. About 1912, the Associated Advertising Clubs adopted the slogan "Truth in Advertising" and subsequently began the organization of Better Business Bureaus. These bureaus have increased in number until, in 1927, there were 41 bureaus in the leading cities of the country, and a central organization, the National Better Business Bureau (Inc.). The purpose of these bureaus is to prevent fraudulent advertising and to aid in the prosecution of fraudulent advertisers. The results of their work have been especially notable during the last ten years. In 1927, furthermore, a discussion of the need for "sincerity" in advertising was begun among advertising men, which holds large promise for the future as a means of increasing the effectiveness of advertising expenditures.

From the managerial standpoint, there has been a steady tendency toward more careful and more intelligent planning of advertising campaigns. This planning has been facilitated by the work of the Audit Bureau of Circulations, which began its operations in 1914. The primary purpose of the Audit Bureau of Circulations was to audit the circulation statements of magazines and newspapers in order to assure their accuracy. Subsequently it obtained, from its member publications, facts regarding the distribution of the circulation of each medium by geographical divisions and by size of town, and an analysis of methods of securing circulation. Although the foundation for its success was laid prior to 1921, the chief utilization of the results of its work has come since that date. In this respect, as in several others, advertising since 1921 has experienced the cumulative effects of constructive measures taken prior to the World War period. Another noteworthy fact regarding the Audit Bureau of Circulations, as well as regarding the Better Business Bureaus, is that the institution was organized by business men and constitutes a conspicuous example of self-regulation in industry.

The planning of advertising programs has been materially assisted since 1921 by the research work of the advertising associations, which have undertaken to supplement the basic data of the Audit Bureau of Circulations by determining the quality of the circulation of various mediums and the duplication in circulation between mediums. Publishers, advertising agencies, and other institutions, as well as individual companies, also have carried out extensive programs of marketing research. The period has been one of exceptional diligence in a search for facts as a guide to advertising expenditures. There is still a large amount of waste in advertising and there are many opportunities for improvement, both in planning and in execution. Nevertheless, vigorous efforts for betterment have been launched which will yield benefits in the future. Much scientific study still is needed for determining what types of commodities, which are not now profitably advertised, are susceptible to effective advertising and how that advertising should be carried out. The attention that is being directed toward the solution of these problems, however, indicates that advertising will have even greater influence in the future than it has had heretofore.

VIII. SUMMARY

It often is stated that marketing costs, in contrast to production costs, have been tending to rise, in ratio to sales, over a period of years. That statement probably is true, but it cannot be proved statistically with the data now available. Furthermore, significant counter-tendencies have been at work, which have partially offset some of the increases. Some manufacturers, in order to increase their volume of sales, either with a view to securing production economies or to having the pleasure of doing a bigger business, have increased their expenditures for selling and sales promotion more rapidly than their sales have grown. Other manufacturers have followed a similar course with the hope of stabilizing their operations and their earnings. Still other manufacturers and wholesalers have been forced to increase their selling expenses because of their customers' growing practice of buying from hand to mouth. The changes in retail trading areas and the competition of chain stores have had the effect of increasing the expense ratios of numerous wholesalers. In department stores, too, there has been a tendency for the expense ratios to increase. On the other hand, many manufacturers have had no increase in their marketing expense ratios; chain stores have reduced the costs of retail and wholesale marketing in numerous lines; and some of the co-operative associations of farmers have succeeded in cutting marketing costs. Undoubtedly, the application of more scientific methods will result eventually in large economies in marketing. A detailed discussion of that problem, however, would take us far beyond the scope of this survey. The significant point for the task at hand is that during the period from 1922 to 1928 substantial reductions in marketing costs did not occur in most industries. The conditions which have existed during this period have led manufacturers and merchants in most instances to seek to stimulate and to satisfy demand rather than to reduce their marketing expenses.

During the period since 1922, the rise in standards of living, changes in methods of living, new inventions, and the exercise of merchandising ingenuity by manufacturers and merchants, have combined to cause large-scale changes in the character of the demand in the United States. Among these changes, the introduction of new types of merchandise, the broader emphasis on fashion, and the increased rapidity of style changes have been especially noteworthy. The result of these changes has been to yield prosperity for some industries and to necessitate retrenchment and reorganization for others. A premium thus has been placed on constructive merchandising ability and more attention has come to be given, therefore, to specialized merchandising management. By no means all the problems growing out of these changes in demand have yet been solved.

The automobile has been one of the most pervasive influences affecting marketing as well as production during recent years. In addition to its direct influence on demand, its use as a transportation agency, supplemented by the construction of good roads, has facilitated changes in demand in many communities and has led to the widening of retail trading areas. These changes also have enhanced the prosperity of some groups of manufacturers and merchants and have created conditions which have necessitated, or will necessitate in the near future, readjustments in operating methods for many other manufacturers and merchants.

The data presented in the section on hand-to-mouth buying showed that there was less advance ordering in a majority of industries in 1927 than in 1922. The average size of orders also commonly declined during this period, the degree of change being much greater in some industries than in others, and several industries manifesting no tendency toward hand-to-mouth buying. One effect of these changes was to enable the volume of business transacted in 1927 to be handled with more than a billion dollars less capital and credit than would have been required if the 1922 inventory ratios had prevailed in 1927. The effect which this development has had in holding down prices and interest rates has been far from negligible. With the increase in the number of styles and in the variety of products offered for sale, merchants were forced to buy individual items in smaller quantities in order to keep their aggregate inventories from increasing. By buying from hand to mouth, they also could lessen their risk of loss from declining prices and from style depreciation. The existence of surplus producing capacity in numerous industries enabled the buyers to secure prompt deliveries on small orders, and the action of the railroads in accelerating traffic movement worked to the same end. The advantages of prompt and dependable railroad service have been pointed out. The potential danger of complete reliance on the continuation of that type of service also should be recognized, since any substantial interference with it would result in a scramble for goods to build up depleted reserve stocks, and price inflation might be expected to follow.

In the field of distribution, the most notable change during the last eight years has been the expansion of chain stores. They have attained dominant positions in the gasoline and variety goods businesses and rapidly have been approaching dominance in the grocery, drug, and shoe trades. The changes in buying habits in rural communities and small towns, with their impending effect on mail order sales, presumably impelled two of the largest mail order companies to launch chains of stores. The concentration of retail buying power in chain store companies and other large retail organizations not only has been cutting down the wholesalers' fields of activity and lessening the scope of opportunities for small-scale business enterprises, but it is also bringing to the fore a new problem of public policy in dealing with discriminations in terms of sale.

In the co-operative marketing of farm products, the most noteworthy development since 1922 has been the growth of large-scale enterprises. Co-operative associations have taken a place in "big business." The large-scale co-operative associations fall into two main groups, differentiated by their aims and methods. One group comprises the associations which have sought primarily to exercise a monopolistic power to valorize the crops of their members. They have not been successful. The associations in the other group have successfully supplanted private business by manifesting broader vision and greater foresight in introducing economies in marketing, as in the case of the livestock associations; in improving the quality of the product of their members, as in the case of the dairy associations; in utilizing effective methods of sales promotion, as in the case of the citrus fruit growers; or by a combination of these services. Co-operative marketing has not been able to alleviate immediately the distress of farmers whose crops exceeded market requirements. It has not been a panacea for the ills of overproduction. Its successes have come where the members and their leaders have had the patience and the vision to work out new methods of operation which can come to fruition only over a fairly long period of time. In dealing constructively with the fundamental problems in marketing a particular commodity, a large-scale co-operative organization has great advantages over numerous small-scale associations working independently of each other.

Installment selling has been one of the most discussed marketing topics during the last four years. From the analysis of the subject in this survey, however, it appears doubtful if installment sales have increased more rapidly than total retail sales since 1923. Agricultural implement manufacturers increased their sales on installments in order to meet agricultural credit needs. Aside from agricultural implements, the chief industries in which sales on installments increased were those where the total demand was increasing and where the particular products were especially suited to that type of sales promotion. The sales of electric refrigerators and radio sets, for example, could be facilitated by means of installment terms, just as the same terms previously had been used for the sale of sewing machines and pianos. There is no real evidence to indicate that installment selling has been undermining the integrity of the credit structure or becoming more of a financial hazard than it was, for example, in 1920. The companies and institutions financing installment sales have learned the necessity of exercising discretion in the selection of credit risks and of avoiding excessively liberal terms.

Advertising has been a positive factor in stimulating the increase of sales in numerous industries since 1921. From 1921 to 1927, the total annual expenditures for advertising in the United States probably increased about 50 per cent. The increases were especially notable in 1923 and 1926. The industries in which particularly noteworthy increases in advertising expenditures took place were: radio sets, electric refrigerators, automotive equipment, foods, home equipment, soaps and cleansers, silverware, clocks and watches, pens and pencils, and toilet articles. Several of these industries were those whose sales expanded with especial rapidity.

During this period the art and typography used in advertising were improved; higher standards of business practice were attained; and advertising tended to become more effective. Much of this progress was based on foundations laid prior to 1920. Further improvements may be expected as a result of constructive steps taken since 1920.

The chief characteristics of the advertising developments since 1921 are typical of nearly the whole field of marketing activities. The major changes represent the culmination of influences at work prior to 1920. The war period and the crisis of 1920, by upsetting traditions and adding a new spur of necessity, may have accelerated some of the changes, but the foundations had been laid before. Most of these changes, furthermore, are not yet completed. In fact, in view of the conditions now existing and in light of the opportunities almost untouched by scientific research, it seems probable that there are impending changes in marketing methods even greater than those that have occurred since 1921.